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Odd man out

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Cover Photograph: Odd man out *Photo: L. Mitchell*

Economic Possibilities of Small Dairy Farms

E. A. ATTWOOD, M.A.
University College of Wales

The example of a forty-acre farm in Montgomeryshire is quoted to prove that by intensive production the small farm can overcome its inherent difficulties and make much greater profits than are generally expected.

MODERN agricultural techniques and specialized equipment are generally giving the larger farmer considerable advantages in production, and the small farm has come to be regarded by some people as inevitably uneconomic and unprofitable. Though within the next decade there are likely to be fewer small farms, they will almost certainly remain numerically the most important unit in British farming. Conditions for the small farmer are unlikely to improve in the immediate future, so the economic potential of these holdings will have to be exploited to the full, if they are to give him a reasonable return.

Far too little attention has been given in this country to the limits of profitable development for the small dairy farm; most surveys of the economics of dairying give only the average results, without any indication of the achievements of the better farmers. Yet it is these achievements which should be examined and used as the target to be aimed at; the average represents both the bad and the good farmer; it is of no real value as a measure of the potential economic results of dairying on a limited acreage.

As an illustration of the differences between the average and the good small dairy farmer, the results derived from the Welsh Farm Management Survey for 1956-57, carried out by the Department of Agricultural Economics, University College of Wales, are set out in Table 1, on p. 216. These results are given for two groups of dairy farms: those of under 50 acres, and those of between 50 and 100 acres, but the same basic principles of farm organization which lead to economic success can be seen in both groups.

Higher output by more intensive farming

It is outstandingly clear from the figures overleaf that the most profitable farms had outputs much higher than the average. These higher outputs within each group were due not to bigger acreages, nor to any marked physical advantages, but to much more intensive farming. A comparison of the rents paid shows that the most profitable farms were not on appreciably better land, but they certainly made much better use of the land they had. They had a greater intensity of stocking than the average and, in particular, carried a larger number of dairy cows. Moreover, the individual animals were much more productive than those on the average farm, and the intensively-managed dairy herd on these farms was usually supplemented by a highly productive subsidiary enterprise. All this was accomplished with no more labour than that of the average small farm, so that the output per man on the

high-income farms was far greater. To achieve these high outputs, considerable quantities of feedingstuffs were bought. It is undoubtedly a mistake for the small dairy farmer to attempt to be completely self-sufficient in feed, for it is essential to get a high output if one is to make a high profit, and this can only be done on the small farm by a considerable input of purchased feedingstuffs. It is far more important to see that the feedingstuffs are efficiently converted into a saleable product than it is to attempt self-sufficiency by eliminating the buying of feedingstuffs altogether.

The production of the best smaller farms in the sample was over £100 an acre, and indeed the most profitable farm had an output of £194 an acre, and a net farm income of £1,350. These high outputs enabled the farmers to overcome many of the inherent disadvantages of most small farms. Yet the limits of profitable expansion of output are rarely, if ever, reached on small farms in this country. On the average small dairy farm there are very great possibilities of increasing the farm income by expanding the total output. Although this will necessarily involve higher total costs, the gap between costs and returns will widen, given reasonably good management, and the farm profit will therefore go up.

Table 1

Economic results of a sample of small dairy farms 1956–57

Size of farm	0–49 *acres*		50–99 *acres*	
	Average of:		Average of:	
	all 26 farms in group	5 best farms in group	all 29 farms in group	5 best farms in group
Average size (*acres*)	39·7	39	76·1	79·7
	£	£	£	£
Net farm income	632	1060	726	1431
Value of labour of farmer and wife	445	402	456	476
Enterprise profit	187	658	270	956
TOTAL PRODUCTION (excl. direct subsidies)	2931	3947	3837	4612
of which:				
Dairy (milk and cattle)	2082	2598	2787	3450
Pigs and poultry	671	1224	730	777
TOTAL COSTS	2311	2896	3165	3709
of which:				
Purchased feed	1228	1807	1507	1625
Rent	126	132	174	168
Paid labour	241	239	417	465
Total stock (in cows units)	24·1	27·3	36·1	37·6
Number of cows	14·8	17·0	20·6	23·2

Montgomeryshire farm

A farm of this high-income group with outstandingly successful results is a 40-acre holding in Montgomeryshire. It lies at an altitude of between 600 and 650 feet, with a slope mainly facing north-east; the soil is light to medium, and is not naturally very fertile. Indeed in many ways the physical features fall short of those usually listed as necessary for a successful small farm, yet in spite of this the farm is extremely productive, with a high yielding dairy

herd as the main enterprise. The only subsidiary enterprise is poultry; but the results have been very poor over the past year, so that the dairy enterprise has in fact been the only important source of income. As can be seen from Table 2, the net profit from the dairy herd was almost £60 per cow, after costing all the labour. This particular farm was unusually dependent on the dairy herd in 1956–57, but it is certainly a very good illustration of the possibilities that exist today on the efficiently run farm of under 50 acres.

Table 2

Milk production on a small Montgomeryshire dairy farm 1956–57 costs and returns

	per cow £	*per gallon* d
Food: Bought	45·1	11·08
Home-grown	12·1	2·97
Grazing	9·9	2·45
	67·1	16·50
Labour	17·2	4·22
Miscellaneous	12·7	3·13
Depreciation of herd	6·4	1·58
GROSS FARM COSTS	103·4	25·43
Less Sales of calves, manurial residues, etc.	9·9	2·44
NET FARM COST	93·5	22·99
Returns from all milk produced	152·0	37·37
Profit	58·5	14·38
QUANTITIES OF FOOD FED: (*excluding grazing*)	*cwt*	*lb*
Bought concentrates	24·7	2·83
Silage	111·9	12·84
Average no. of cows in herd	19·1	
Average yield per cow	976 gallons	
Total production of milk	18,640 ,,	
Total production per acre	460 ,,	

There is no magic formula by which this farmer has succeeded, for the farm policy is very simple and one which could be followed without difficulty by almost every other small dairy farm in this country. The basis of the farm economy is a herd of 20 cows and 15 followers, which are fed on grass and silage off the farm, with the addition of just under 1¼ tons of purchased concentrates per cow. To maintain this rate of stocking, together with very good, but not exceptional, yields per cow, the production of grass has been pushed up to a very high level, and the purchased feedingstuffs are carefully rationed.

Lower costs per gallon

The system of farming that has been adopted is fundamentally very simple, but it gives the farmer the opportunity of concentrating on the job of producing milk. Milk production last year averaged 976 gallons for every cow in the herd, which is very creditable, and this position was reached without buying in very expensive cows. The herd has been bred from ordinary commercial animals bought at local markets; it is not pedigree, but a careful pro-

gramme of breeding from the highest-yielding cows has been followed with the aim of producing a cow which gives a steady yield throughout the lactation.

The net expenditure per cow on this farm is just below £95, which is the same as that on the average Welsh dairy farm. With a yield per cow that is almost 200 gallons higher than the average, however, the costs per gallon are considerably lower. These low costs per gallon are due primarily to:

1. the spreading of the maintenance ration over a large output of milk;
2. economies in the net cost per unit of food, derived from the low cost per unit of nutrient of home-grown feedingstuffs and the judicious use of purchased feed;
3. economies in the use of labour, due to the high number of cows carried per man. These could be increased still further, for the existing buildings are by no means laid out to the best advantage.

To achieve high yields of grass, nearly £200 is spent annually on fertilizers. This is certainly a large amount for a 40-acre farm, but the expenditure per gallon of milk, which is the real criterion, is not very much more than the average. The grass of the farm is expected to provide at least maintenance plus two gallons over the whole year, and a lot more than this in the spring. In winter, 70–80 lb of grass silage are fed per cow and, with 5 lb of cereals to provide extra starch, form the basis of the feeding policy up to the first two gallons; purchased cake at between 4 and 5 lb per gallon is fed after that. Altogether about 110 tons of silage are made from 18 acres of grassland, and this yield was maintained last year in spite of the very dry spring.

At present there are two plans for developing the farm still further. One is to reduce costs by using more cereals, in order to cheapen the cost of the concentrate ration without cutting down the total quantity of concentrates fed. The other is to expand milk production until it reaches 500 gallons per acre, by maintaining a herd of at least 20 cows at yields of about 1,000 gallons per cow. Another line of potential improvement lies in a reorganization of the buildings, which are no longer suited to the modern equipment that is available; this will not increase the profits, but it will lessen the burden of manual labour involved at present in feeding silage and cleaning out inefficiently designed buildings. The temporary setback to the poultry enterprise, due to a high incidence of fowl paralysis in the pullets bought at the beginning of the year, has been overcome and no recurrence of this trouble is anticipated.

Recipe for success

This farm shows quite clearly what can be done with the resources available to almost every dairy farmer in this country. It has no extraordinary advantages which can account for its success; the basic farming system is a very simple one, in which cows convert the cheapest of all home-grown foods, grass—together with a considerable but not excessive amount of purchased concentrates—into milk. The recipe for success is just one of good yields and heavy stocking of dairy cows, with grass as the main raw material in the production process. Though the widespread adoption of this system would accentuate the difficulties of the M.M.B., which would have to sell the extra milk produced, no farmer today can afford to restrict his output, for a low

output on a small farm inevitably brings a low profit. A high output from a basically simple farm production plan is the best route to a good income.

The proof of this system lies in the results. A 20-cow herd on a farm of 40 acres can produce a profit of £1,120, after allowing £350 for family labour, and charging a rent of £4 an acre. The total farm income was therefore almost £1,500, without any contribution from the intensive enterprises of pigs or poultry, which can make a valuable contribution to the economic results of any small farm. The output of the poultry on this farm has already been very considerably improved this year, and on present yields should contribute a further £250 to the profit of the whole unit.

There can be no doubt of the economic possibilities of a 40-acre holding if it is properly managed.

Cheaper Wintering for Beef Cattle

D. G. FILMER, B.SC.(AGRIC.), DIP.AGRIC.(CANTAB.)
and
J. O. LATHAM, B.SC.(AGRIC.)
School of Agriculture, Cambridge University

We must cut the cost of wintering if we are to produce beef more cheaply.

THE high cost of wintering accounts for much of the total cost of producing finished beef animals on most farms. There are two main ways of trying to cut it: by reducing the number of wintering periods in the animal's life, and by using methods of husbandry which will save food, labour, or housing costs.

Rearing autumn-born calves cuts down total wintering costs because the first winter of the animal's life coincides with the expensive rearing or suckling period, and the second six months may then be spent at grass. Most authorities agree that the cost of rearing an autumn-born store animal to two years old is some £6–£10 less than for a spring-born animal. In single-suckling herds where autumn calving is practicable, cattle can be fattened on grass with only one expensive winter period. Some farmers, using calves born in the early spring, can produce animals fat from yards at the end of their first winter at just over a year old. But on many farms the greatest hope for reducing beef costs appears to be in wintering techniques which reduce the cost of either food, labour or housing, or a combination of these.

This second method of approach is being investigated at Cambridge, and, as an initial step, twelve farms have been visited in the eastern counties and Midlands, where attempts are being made to cut wintering costs. These twelve farms were selected to cover the various soil types: three are on light land, five on heavy land, and four are on intermediate types of soil. It will be some years before sufficient information has been collected to eliminate seasonal and economic variations, but a brief commentary on the methods

seen may be of interest. The survey was carried out during the mild, wet winter of 1956–57 and the impressions should be judged with this in mind.

Outwintering on foggage

Outwintering on foggage was seen in some form on six of the farms, the soil types ranging from clays to light Breckland sands. It must be stressed, however, that the clay soils are reasonably free draining. On really heavy clays such as the gault where drainage is difficult, outwintering on foggage appears to be impracticable. The meaning of the term "foggage" has changed within the last ten years. Nowadays the term has come to imply grass or grass mixtures that have been encouraged to grow strongly in the late summer and autumn and by design left *in situ* for winter use. Cocksfoot seems the most popular grass for this purpose on all types of soils. On heavy land it is sown in wide rows to encourage its tufted habit and to allow it to develop a sponge-like mass of roots near the surface. These two factors help to prevent plant and soil being damaged by poaching during grazing. On lighter land, where poaching damage is not likely to be excessive or the ley is due to be ploughed up, foggage is produced from ordinary cocksfoot or grass leys (sown in narrow rows). It is normal practice to take a seed crop or a cut for hay or silage in the early summer before shutting up the grass for foggage growth. Hence the foggage can be regarded as a by-product. In one instance, on a heavy land farm, foggage was grown as a catch crop by sowing Italian ryegrass with spring corn. The grass and the combined straw were grazed after harvest throughout the winter, and the stubbles were ploughed as they were bared and allowed to weather in readiness for spring sowing.

Both strip grazing and extensive grazing of foggage are seen on all types of soils. There is very little information about the feeding of foggage. Feeding values differ from farm to farm—a fact which may be linked to soil fertility and manurial treatment when shutting up the grass for foggage. Farmers usually reckoned foggage to provide maintenance, but its feeding value declines during the winter, and extra supplementary feeding is then necessary to maintain adequate liveweight gains. The amount and type of supplementary feeding varies from farm to farm: on heavy land, cake and corn are usually fed in troughs, but on lighter land hay, silage or roots are often carted out to the cattle, in addition to feeding a small allowance of corn.

Silage trough trailer

Although silage is a most useful food to supplement the feeding of foggage, it is expensive to cart and feed. Self-feeding from clamps in the open is not usually successful, even on light land, because of the poaching of the ground around the clamp. One of the best ideas of solving this problem is what might be called a "trough trailer". This is a trough 17 feet long, 4 feet wide, and 1 foot 3 inches deep, mounted on a pair of wheels. It has a towing ring and a rest at one end, and is loaded and moved from the clamp to the field by a tractor fitted with a front-mounted loader and a hydraulic pick-up hitch. A trailer of this type has an outside feeding space of 42 feet and holds up to 2 tons of silage—two days' feed for 20–30 yearlings being outwintered

on foggage. The trailer is put down at a different place each time to prevent undue poaching.

A definite preference for Hereford-cross cattle for outwintering on foggage was noticed. Farmers consider that this cross outwinters well because of its thick skin and its ability to grow a thick coat. The method of rearing does not appear to affect the success of outwintering on foggage, but some form of shelter from the wind and some dry ground for the cattle to lie on seem to be essential for complete success. Although cattle were seen being fattened on foggage on two farms, the main use of this type of feeding seems to be for wintering store cattle.

Arable crops and by-products

On light land and free-draining loams, arable crops and by-products can play a very useful part in reducing the cost of wintering cattle. In a typical case of outwintering on light land, cattle of all ages were folded on kale in the autumn, and lay back on adjacent stubbles where they could eat the combined straw and carted sugar beet tops. When the kale was finished, the beef cattle were folded on sugar beet tops and silage was carted to the "lie back" fields. This was followed by carted silage and mangolds on the leys that were due to be ploughed in the spring. Cattle were sold fat off the folded sugar beet tops at 2½ years old. These fattening cattle received an additional 3–4 lb of crushed corn a day during their final autumn and winter. On another farm, store cattle were outwintered on folded kale and foggage and given access to oat straw ricks. Even on farms where some yarding of the cattle is necessary or desirable during the winter, the yarding period is often reduced by folding or grazing on grass or arable crops in the autumn and early winter, and by turning the cattle out in the spring on to fields of "early bite" grass (mainly Italian ryegrass or H.1 ryegrass).

Temporary straw yards and pads

Temporary straw yards and pads are ways by which it is possible to combine the advantages of outwintering on cheap food with some of the protection given to stock by conventional yarding. Temporary straw yards are made of baled straw, poles, thatching straw, etc. They closely resemble ordinary yards and need little further description.

The idea of a straw pad, however, is novel to many farmers. This is merely a flat heap of straw about a foot deep, placed in a dry, sheltered part of a field—but not too close to a hedge, otherwise the animals tend to burrow through it. Movable hay-ricks and troughs are arranged in the middle of the pad. The animals dung and sleep on the straw and it is kept bedded down frequently. The cattle benefit by the dry lying and the warmth of the dung below. Like straw yards, pads are a very convenient way of making a dung heap close to where it is wanted. They provide a means of stocking farms and outlying fields in the winter where there are no permanent buildings, and appear to give a protection much beyond their apparent worth. One bunch of two-year-old Friesian steers which outwintered on a straw pad, and were fed on straw with a little hay, mangolds and 2 lb of corn a day to supplement very limited grazing, maintained good condition during

the winter of 1956–57 and gained about 1 lb a day. Another bunch of two-year-old Friesian steers which were grazed on foggage with limited supplementary feeding grew slightly quicker. Cattle semi-outwintered in straw yards and on straw pads did not seem to suffer the check in growth that yarded cattle often experience when first turned out to grass. Both straw yards and straw pads might well be fitted into outwintering systems (on foggage, for example) on all types of soil, to give some form of protection to the stock.

Self-fed silage

The self-feeding of silage to beef cattle was seen on four farms and to dairy cattle on two. On one light land farm, silage was being self-fed to beef cows and calves from a clamp in the open. On all the other farms, however, the method was being used as a means of reducing the cost of yarded cattle. The other two light land farms in the survey had tried self-feeding silage from clamps in the open, but had not found it to be successful because of the puddling round the clamp and the wastage of silage.

The self-feeding of silage by cattle in yards can be fitted into many farming systems, and does not necessarily involve any large capital expenditure in adapting buildings. On one farm, for instance, the clamp was made in the wide approach to an old yard. The brick walls of this approach formed the sides of the clamp, and the silage had been cheaply roofed with spoiled hay from the previous harvest. Fifty yearling Hereford-cross cattle were growing and thriving on 60–70 lb of this silage and about 2 lb of crushed corn each, daily. The only labour involved was the periodic bedding down of the yard, concentrate feeding, and moving the restraining wire back along the feeding face as the silage was eaten. On another farm, a silage stack had been built in the middle of a semi-covered yard and the cattle allowed all-round access to the stack.

Certain general points stand out from the various experiences of farmers using this method of feeding silage.

(a) Self-fed clamp or pit silage seems an excellent way of feeding store cattle and beef cows and calves, but in some cases does not seem suitable for fattening cattle. Animals spend a great deal of time in feeding (particularly with silage made from unchopped material), and it is thought that such activity is not conducive to rapid fattening. One farmer tried to overcome this difficulty by placing racks and troughs as a barrier close to the feeding face, and cutting and forking the silage into these twice daily.

(b) As 60–70 per cent of the dunging is done in the vicinity of the feeding face, the ground should slope away from the face and adequate arrangements should be made for dung disposal.

(c) Many farmers have found that a restraining electrified wire or tubular steel feeder is very helpful in preventing burrowing into and wasting of the silage. For continuous feeding, 6–12 inches of feeding face are usually allowed to each animal, depending on size and whether the cattle are dehorned. When periodic feeding is practised, 3 feet or more per animal is necessary. Most farmers consider continuous feeding to be essential for the proper working of the system.

(d) Both grass and arable silage are considered suitable for self-feeding

by beef cattle. Consumption of silage under continuous self-feeding conditions seems higher than when the silage is fed loose, but no accurate figures are available on this point. It has been suggested that silage made by a cutter-blower might be more suitable for fattening cattle, as it could be pulled out and eaten more readily. The experiences of two of the farmers visited on the survey do not, however, support this view.

Costings linked to liveweight gains

Before even tentative conclusions about the relative advantages of these ways of cheap wintering may be drawn further investigations are needed. More detailed records of costs and of possible effects of the adoption of such outwintering systems on total farm income are required than are available at present, but where applicable these methods appear to be considerably cheaper ways of wintering store cattle than normal yarding. Where good yards are available, and where men required in the summer must be found employment in the winter, cattle may continue to be wintered on traditional lines. But such a position does not obtain on all farms and further study of alternative ways of wintering cattle is well worth while. Wintering methods may influence the rate of growth or fattening on grass during the subsequent summer period. The real value of these systems therefore can only be assessed by measuring the liveweight gains during the winter and the following summer in relation to the cost of feeding and housing.

To obtain this information cattle are being weighed by a portable weighing machine at regular intervals on many farms in the eastern counties where different systems of wintering are practised. It is hoped that in this way it will be possible to make an effective comparison between various methods of wintering.

In the future the beef producer must become much more "weight conscious". The weighing machine will have to replace the eye as a means of first assessing and then improving the efficiency of various feeding systems in beef production.

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Herbage Seeds as Cash Crops

A. GANE, N.D.A.

National Agricultural Advisory Service, Eastern Region

A wise choice of grasses will provide good grazing almost all the year round, and a cash return from the seed as well.

SALES of cash crops on some farms are far too low. This may be due to poor yields or too few saleable crops for the size and stocking of the holding. The competent farmer should have no difficulty in improving yields by appropriate cultivations, choice of varieties and manuring, but it may not be so easy to increase the acreage of cash crops if labour is limited. More cereals may overload available storage, or overtax the workers at harvest so that preparations for the next season's crops are jeopardized: furthermore it is not good practice to have too high a proportion of cereals in the rotation, because of the risk of introducing such troubles as take-all, eyespot, cereal root eelworm, or persistent weeds such as wild oats or blackgrass.

Herbage seeds provide an alternative cash crop with interesting possibilities. Having a life of up to four years, they allow a distinct break in the rotation during which root development will improve soil texture. The land is rested from cereals and valuable grazing is provided for stock. The equipment needed is no more elaborate than that in use on most cereal-growing farms; in fact some grass seed crops extend the harvest and enable better use to be made of the machinery available.

A farmer proposing to grow seed crops for the first time should ask his district advisory officer to tell him of the pitfalls. The weed population is important; some weed seeds are similar in size and shape to the cultivated species. For example, blackgrass (*Alopecurus myosuroides*) cannot be separated from ryegrass or cocksfoot, though it would be less of a problem in timothy or clover. The ideal is a clean farm for a start. Even then there is the question of isolation. The seed field should not adjoin fields in which other strains of the same species will be allowed to come into head, as would happen in a hay-field. This may be difficult to achieve on a farm where much of the land adjoins that of neighbours.

Grassland policy based on seed production

Future planning is simplified if the grassland policy of the farm is made to rotate around the species and strains selected for seed production. This minimizes pollination problems and ensures that seeds left in the soil or carried about the farm in fodder or muck will not affect strain purity. Italian ryegrass presents a particular problem, with its vigorous growth and free seeding habit. It may conveniently be worked in to rotate with kale on home fields, but its inclusion in the seed plan would rule out the growing of perennial ryegrasses for seed on the same farm. Clearly, thinking ahead will avoid difficulties and disappointment later. When it has been decided which species and strains fit the circumstances of the farm, it is necessary to arrange contracts with local merchants for obtaining stock seed supplies and for the

purchase of future seed crops. A bad harvest year generally means a good growing year for grass, so that the grower using his seed stands for grazing will have some small compensation in the form of extra stockfeed.

A crop which is to do justice to the farmer for several years must clearly have a good start. The choice of undersowing or direct seeding has to be considered carefully. Failures can occur with either if the weather is difficult. The traditional method of establishing perennial ryegrass and red or white clover is under a cereal; the case for undersowing cocksfoot, timothy or fescue is not so good; on balance it may be considered at least to halve the first seed crop. The grower has to decide whether to accept this and make sure of a return from the nurse crop, which may be either a cereal, mustard or possibly peas. Another possibility is to undersow cocksfoot with broad red clover, or timothy with late-flowering red clover, then harvest the cereal in the seeding year, clover in the first year for grazing, hay or silage and seed, and the grasses in subsequent years. The advantage of direct sowing Italian ryegrass or white clover (plus a few pounds of ryegrass) is that it can provide very useful midsummer grazing at a time when keep may be scarce on older leys. Cocksfoot, timothy and fescue sown direct should be allowed ample time to become established in summer and autumn, but any lush growth can be grazed off with advantage from October onwards.

Harvesting spread from July to October

Harvesting seed crops usually begins in early July with fescues and early hay types of perennial ryegrass, continuing with cocksfoot, trefoil, pasture types of perennial ryegrass, white clover and timothy, and ending in September or October with the red clovers. This wide range of harvest dates is associated with an equally wide range of grazing possibilities before or after harvest. Research has not yet established the precise effect that varying seasons of grazing may have on seed yield. Very poor yields can be obtained with indifferent management and no grazing, whereas quite good yields can be obtained with good management and fairly intensive grazing. As the weather at harvesting is so vital, there is a case for the stock farmer spreading his risk and taking something out of the field as milk or meat as well as seed.

Observations have shown that seed crops may usefully be grazed at the following seasons:

Cocksfoot Fescues	August—immediately after harvest to clean up the stubble: then between November and March. Cocksfoot and the fescues should be rested in September and October.
Timothy	January to mid-March. Very winter green; provides valuable grazing at this time.
Perennial ryegrass (*undersown*)	Immediately after harvest and again in November and December.
Italian ryegrass (*spring sown direct*)	After about twelve weeks, and then as available to March.
White clover	If sown direct in spring with 3 or 4 lb of perennial ryegrass: August and September and then as available to the end of May. If undersown: graze the stubbles in autumn and again in April and May.
Red clover (*usually undersown*)	Graze the stubbles and again in spring to the end of May if late flowering red, or cut in early June if broad red.

Growers' experiences

It will be seen that by choosing suitable seed crops and methods of establishment the farmer may have grazing at almost any season of the year and the prospect of a cash return from seed as well. A few examples of new growers' experiences over the years 1955–57 are given below. It should be borne in mind that harvesting conditions in 1955 were good, in 1956 very bad, and in 1957 about average.

1. *Cocksfoot* (S.143) on chalky soil was sown without a nurse crop in 1955. The seedbed was prepared as for barley, with 5 cwt compound fertilizer broadcast per acre. Establishment was slow but fairly even, and valuable grazing was available at three cows to two acres during November and December. Four hundredweight of sulphate of ammonia was applied in spring 1956. The crop was cut with a binder, stooked, and subsequently threshed in appalling weather, and about 1 cwt of seed per acre resulted, worth £17. Subsequently cows and calves grazed the stubble on and off until Christmas, and did very well indeed. After harvest, 5 cwt complete fertilizer was applied and a further 3 cwt sulphate of ammonia was given in spring 1957. The 1957 seed yield was 4 cwt per acre (valued at £35) plus 1 ton of stemmy fodder, and grazing at the rate of three cows and their calves to two acres was available, on and off, from October to December.

2. *Cocksfoot* (S.143) on silt land damaged by sea water in 1953. The grass was established in 1954 without a nurse crop; generous fertilizing included 8 cwt compound fertilizer in the seedbed or after harvest and 6 cwt top dressing each spring. It was harvested with a binder, stacked and threshed, or direct combined with the drum wide open first time over and then picked up from the trail and re-threshed seven days later with the drum set close. The yield of seed totalled over one ton per acre in the three years, with a return of £60 to £70 a year. This method of reconditioning land flooded with salt water has succeeded quite well, with a minimum of cultivations and ample opportunity to apply gypsum. Root development is helping to re-establish the soil structure. After direct combining a sack drier was essential.

3. *Meadow fescue* (S.215) on boulder clay was undersown in barley in 1955 and established as a thin but fairly full plant, the cover crop yielding 7 quarters per acre. In the spring of 1956, 3 cwt compound fertilizer and 2 cwt "Nitro-Chalk" was applied. The crop was sprayed and later rogued by hand. Harvesting was by combine direct and the seed yield of 2 cwt per acre realized £25. Winter grazing at one beast per acre was possible for two months. Three hundredweight of compound fertilizer was applied after harvest, and a further 2 cwt top dressing was given in the spring of 1957. The seed yield in 1957 was 5 cwt, worth £45 per acre, and again winter grazing was available. The fodder from the seed harvest was useful for outwintered stock.

4. *White Clover* (S.100) on chalky marl was established by direct sowing after kale grazed off by cows in spring 1956. A companion crop of 6 lb per acre perennial ryegrass (S.23) was sown with the clover, and 4 cwt compound fertilizer was applied. The seeds were slow to emerge, and accompanying annual weeds had to be topped over twice with the grass mower. Valuable grazing was available in August and early September at the rate of three milk cows per acre. In 1957 (a mild spring) grazing started on 10

March and continued to 5 April at two cows per acre. Further grazing at three cows per acre was available from 13 May to 10 June, at which stage the crop was left for seed. When it was cut and combined from the trail, it yielded 1½ cwt of clean seed per acre, worth £42, plus 15 cwt of very good, rich, green fodder. After harvest 2 cwt superphosphate and 1 cwt muriate of potash were applied, and more valuable grazing was available from 17 September to 4 November.

All these crops are now well established, and will provide a return in 1958 with a minimum of spring work.

Washing of Maincrop Carrots

W. HUGH SMITH, B.A., DIP.HORT.(CANTAB.)
Ditton Laboratory, Department of Scientific and Industrial Research

The effectiveness of washing carrots and the risk of subsequent rotting have been examined by the D.S.I.R. in a small-scale survey.

THE public demand for washed carrots and the growth of pre-packaging has stimulated interest in methods of washing and the possibility of their improvement. At the instance of the Agricultural Improvement Council, a working party set up in 1951, on which the Ministries of Agriculture and Food, the National Institute of Agricultural Engineering and the Department of Scientific and Industrial Research were represented, has carried out a small survey of the effects of washing on the subsequent behaviour of a range of vegetables. As part of this programme they examined small samples of carrots washed and handled in the normal commercial way.

Samples were prepared by splitting the contents of bags into two parts as they came from the field. One half of each bag was washed, and the other half retained without treatment. Both halves of the split consignment were transported and kept under observation, in identical conditions of temperature, ventilation, etc. Five types of standard commercial machines were tried:

A. A rotary type, in which the roots are sprayed with water as they pass along an inclined wire-mesh rotating cylinder.

B. A rocker type, in which the carrots are rocked in a wooden cradle over which water is pumped.

C. A trough type, roofed with coconut fibre matting, against which the roots are rubbed (after soaking in water) as they pass along a rack, and then rinsed.

D. A machine having a slanting rotary drum partially immersed in water, the roots being driven along by a rubber spiral and sprayed with water as they emerge at the upper end of the drum.

E. A spray-chest type, in which the roots are sprayed (after immersion in a tank) as they pass along on a roller conveyor, which turns them over.

The ways in which carrots deteriorate after harvesting have been observed in detail. From the consumer's standpoint the most serious kind of deterioration is rotting. Rot may develop in various places on the carrot: on the leaves left after topping, on the crown, laterally, or at the extreme tip. Noting where it develops has proved important in evaluating the effects of washing machines on the subsequent behaviour of the vegetable.

Wilting and shrinkage can prove troublesome. Lengthwise splitting and mechanical damage to the surface of the carrot are important, and so to a lesser degree is the production of new growth from the crowns, which may be instrumental in spreading rot.

Damage caused by washing

As might be expected, some carrots are damaged while passing through the mechanical washer. The extent of damage to comparable samples of roots was assessed and compared by means of a scoring system, individual roots being placed in one of six categories and points scored as follows:

	Points
No damage	5
Trace	4
Up to ¼ surface area	3
¼–½ surface area	2
½–¾ surface area	1
More than ¾ surface area	0

The score for damage has been expressed by a single value. This is the sum of the points (p) for all the members of a sample (n), expressed as a percentage of the score which would have been obtained had there been no damage at all (5 n). Table 1 shows the scores for all the trials, compared with the scores for control unwashed carrots. The lower the percentage score the greater the damage.

Table 1

Effect of washing on the amount of damage to carrots

None (Unwashed)	Machine A	B	C	D	E
(Score as percentage of full score $\frac{p}{5n} \times 100$)					
98	48	—	—	—	—
96	68	—	—	—	—
100	59	—	—	—	—
98	60	—	65	—	—
96	—	—	—	64	75
95	—	61	62	—	—
91	—	61	—	—	80

All the machines caused considerable damage. There was little to choose between them, though the spray-chest type (E) caused rather less damage than the others. It was noted, however, that this machine often failed to dislodge dirt in depressions on the surface of the roots.

Table 2

Percentage washed and unwashed carrots with rot after 2 weeks at 50°F

Machine Type	Class of rot: Top		Lateral		Tip		Crown		Total—all positions (including tops)	
	U	W	U	W	U	W	U	W	U	W
—	40		7		1		18		72	
A		22		18		3		26		44
—	13		2		0		18		24	
A		11		14		1		8		35
—	4		1		1		7		6	
A		9		15		2		1		26
—	15		32		8		10		50	
A		21		21		18		23		49
C		6		15		8		15		32
—	22		23		11		5		57	
D		25		39		19		5		63
E		36		37		11		5		69
—	17		4		1		1		22	
B		10		11		10		10		28
C		7		8		2		6		23
—	25		16		3		4		41	
B		8		26		7		4		38
E		26		25		3		5		43

U = unwashed W = washed

Rotting in relation to washing

The increased damage due to washing was accompanied by increased rotting as a rule, although this was not evident until about two weeks later. Analysis shows that generally there was more lateral rotting in washed than in unwashed carrots. As an exception, lateral rotting was predominant in the unwashed roots of the fourth trial, but this is probably because there were a great many new shoots on the unwashed carrots; these subsequently rotted and rotting then spread to neighbouring roots. During washing, old growth was cleaned off most thoroughly by the type C machine and fresh growth was shown to be slower in developing in the washed samples. With the type C and E machines, the amount of rotting at the tips of the roots was similar in washed and unwashed samples; with all other types of machine, washing was followed by an increase in the percentage of roots with rot at the tip. No consistent relation in the occurrence of rot at the crown between washed and unwashed carrots could be detected.

By and large, washing did not appear to cause any substantial increase in the amount of rotting over a period of two weeks in carrots kept at 50°F. At 60°F, rotting was more rapid, as is shown in Table 3, but the difference between washed and unwashed was comparable to that at the lower temperature. The high level of initial rot in this particular experiment is due

partly to the presence of rotting residual tops and partly to the fact that the carrots had been dug one month before the date of washing and kept in a barn.

Table 3

Progress of rotting in washed and unwashed carrots at 50°F and 60°F

Temperature Degrees F		No. days after washing 2	8	13
		Percentage roots with rot		
50	Unwashed	20	37	42
60		22	45	57
50	Washed (Machine D)	24	35	57
60		32	46	63
50	Washed (Machine E)	29	37	55
60		27	39	69

Freshly dug carrots often split shortly after coming out of the ground. It was thought that washing might increase the number of split roots, but only in two out of eight trials was it observed to increase splitting, and then only slightly.

Washing very slightly increased the number of broken roots; it affected wilting very little. Only in two trials were washed carrots found after two weeks to have wilted a little more than unwashed carrots.

Appearance and saleability

From the point of view of the salesman the washed carrot must look bright. To this end it is essential that there should be some slight but evenly distributed abrasion of the root surface. (It should be noted that there is no "skin" to the carrot root.) The spray-chest type of machine (type E) does not abrade the carrot surface evenly, and the roots lack brightness. Carrots passed through the other types of machine are bright while they are still wet—a condition which may persist for two or three days in the bag after washing. When the surface dries, however, a whitish coating appears and gives the roots a dull appearance. This is probably due to the presence of a residue of cell debris. Machine type C was found most successful in producing a clean root in which the defect was least noticeable.

The work described in this article was carried out as part of the programme of the Food Investigation Organization of the Department of Scientific and Industrial Research. The trials and recording of observations were carried out by Mr. M. J. W Webb, on secondment from the National Vegetable Research Station, with the assistance of Mr. I. Kemp, of the National Institute of Agricultural Engineering.

Climate and Liver Fluke

C. B. OLLERENSHAW, B.SC., PH.D.
Veterinary Laboratory, Weybridge

It may soon be possible to predict the possibility of severe epidemics of liver fluke from the weather—and forewarned is forearmed.

OUTBREAKS of liver fluke disease have long been associated with wet summers. Climate cannot directly affect the development of the parasite in the sheep which, being warm-blooded, insulates the parasite from the external environment, but it is most important during the remainder of the life cycle, namely the hatching of the fluke egg, development of the parasite into tadpole-like *cercariae* within the intermediate host (a snail), and the encystment of these *cercariae* on the herbage until eaten by the sheep. Let us look at the interaction between the parasite, the snail, and the external environment to see whether there is any precise relationship between the incidence of fluke disease and climate.

A number of other factors besides climate constitute the external environment, and may be expected to have some effect on the life cycle of the liver fluke. For instance, the topography of the land and the type of soil will influence the distribution of the snail host. Since, however, such factors are relatively constant from year to year, they have little effect on the varying incidence of the disease in a given area. Our observations suggest that temperature and moisture are the most important factors influencing the size of the parasite population. Temperature affects the development of the fluke egg as well as the maturing of the *cercariae* within the snail. It is important in two respects: firstly, the critical temperature of 50°F, below which development of the fluke egg and larvae cannot be completed, is sufficiently high to prevent development during considerable periods of late autumn, winter and early spring in this country; and secondly, even when the temperature is above the critical, the parasite takes so long to develop that it suffers prolonged exposure to the effects of other environmental factors. The effect of temperature will, however, be broadly similar in different years, so that the fluctuation of liver fluke disease in any area cannot be attributed to it directly.

Moisture the dominant factor

In this country, moisture is undoubtedly the most important of all environmental factors. It determines the availability of the snail host, without which the parasite cannot complete its life cycle. Given adequate moisture, the snail becomes active, feeds, and eventually reproduces; without it the snail ceases to be active. The density of snails and the area of colonization are, therefore, largely dependent on the prevailing moisture conditions.

The parasite, too, is greatly influenced by moisture. If conditions are too dry the egg dies. Development of the parasite in the snail is similarly dependent on moisture. Under good conditions, snails grow rapidly and are able to

support the development and production of large numbers of *cercariae*. In a drought the snails do not feed, and the parasites within them fail to grow and multiply.

Moisture is again necessary when the *cercaria* leaves the snail to encyst on the herbage, and although the cyst is relatively resistant, its viability also is influenced by moisture conditions in the herbage.

Although the density of snails and the area of colonization depend so much on moisture, appreciable changes in the numbers of snails occur only after changes in moisture have been maintained for a number of weeks. Snails have to grow to maturity before they can lay eggs, which in turn need time to hatch before the population increases. On the other hand, short periods of adverse moisture conditions do not markedly decrease the number of snails.

The fluke egg, by contrast, is quick to respond to changes in moisture. In areas where the disease is endemic, there is a never-ending supply of fluke eggs passed by the stock on to the pastures, and these begin to develop as soon as conditions become suitable. It is quite possible to have fluke eggs hatching and infecting snails before there has been any increase in the snail population. Under suitable conditions, development of this infection in the snail has been known to result in herbage infestations, which have produced acute outbreaks of the disease. Occasionally these outbreaks have been associated with distinctly low snail populations. It seems that in those areas where outbreaks of liver fluke disease occur there are always enough snails to provide hosts, should conditions for the hatching of the fluke egg and development of the infection in the snail be suitable. Because moisture influences both the fluke egg and the snail, it is usual to find large populations of snails when acute outbreaks of the disease occur; the large snail population has not, however, been a necessary prerequisite to the outbreak.

Measurement of temperature and moisture

Temperature is easy to measure, but it is not so simple to estimate its actual effect on the rate of development of the parasite in small pools, ditches and undrained areas, where part of the life cycle is spent. However, we are satisfied that significant development occurs only between May and October inclusive. The precise period may vary a little in different parts of Britain. Experiments suggest that during this period the minimum time for development from fluke egg to mature *cercaria* is ten weeks. Normally it is twelve weeks before the production of *cercariae* begins in quantity, and about fourteen weeks before dangerous numbers can be expected on the herbage.

Effective development is, however, possible only when suitable moisture conditions prevail—that is, when habitats are covered with a little free water. These conditions do not occur in any area until the soil attains "field capacity"—that is to say, until it is holding all the water it can against the force of gravity. Any subsequent addition of water above that required to bring soil to field capacity either drains away or accumulates in the flukey areas, a continued excess of water increasing their size and number. Thus the critical point in determining the suitability of moisture conditions for the life cycle is field capacity.

Comparison of the rate of evaporation and rainfall makes it possible to determine the state of the soil at any time;* field capacity is attained when rainfall exceeds evaporation. Normally soil attains field capacity in autumn, retains it throughout winter and loses it in spring. In other words, suitable moisture conditions for development of the flukes are ordinarily maintained in that part of the year when temperature limits development. However, wet summers do occur, and it is in such years that fluke outbreaks can be expected. For fluke cysts to be deposited on the herbage, it is necessary for rainfall to exceed evaporation for three months during that period of the year when temperature does not limit development.

Three patterns of fluke distribution

Obviously, there will be many variations in the sequence of "wet" and "dry"† months in different parts of the country and in different years, but it is possible to discern three basic patterns, and these go some way towards accounting for the geographical distribution of liver fluke in this country.

The first pattern exists in south-east and east England, where three wet months rarely occur in the period May to October. As a result, the life cycle cannot be completed in the normal life span of the snail, and little or no fluke is to be expected in such areas.

The second pattern is where all the months are wet. Such conditions exist over great areas of hill country in England, Scotland and Wales, where there is a very high rainfall. As a result, it might be expected that fluke disease would be a great problem to the hill farmer. That this is not so is due to the fact that the maintenance of continuous wet conditions gives rise to the formation of peat and leached soils, which, because of their acidity and lack of mineral constituents, are unable to support the necessary snail population. Nevertheless, the snail is found in small, localized habitats which are flushed with spring water containing the necessary minerals. Moisture conditions in such places are ideal, but often the summers are sufficiently short and cool to restrict development, so that much of the infection overwinters in the snail and comes on to the herbage in the following year. Inevitably there is some parasite mortality during the winter, so that the resulting infection is smaller than if it had developed in one year. All these factors tend to maintain a low but constant yearly infection of the stock, and since the hill ewe has a long life, the majority of cast ewes are infected with fluke; the infection is rarely severe enough, however, to cause a heavy mortality. The number and size of areas of infection on hill farms vary; in some districts, sheep need to be dosed regularly to prevent losses from chronic fascioliasis, whilst in others this is not necessary. On all farms there is the occasional sheep which seems to develop a preference for flush herbage, and as a result dies of acute fluke disease.

The third pattern varies between the two extremes; occasionally all the months except October are dry, occasionally all are wet. Usually at least two or three, often four, months are wet so that the life cycle has every chance to

* The Calculation of Irrigation Need. *Ministry of Agriculture Technical Bulletin No. 4*, (1954). H.M.S.O. 2*s*. 6*d*. (by post 2*s*. 10*d*.).

† "Wet" indicating that rainfall exceeds evaporation, and "dry" that evaporation exceeds rainfall.

continue. Liver fluke disease is to be expected in areas with this pattern, the varying wetness accounting for the varying incidence. Lowland areas in the west of England and Wales conform to this pattern.

Anglesey is a typical example of an area with the third pattern. It has many sheep, largely bought in each year from the Welsh hills, and we have seen that these sheep will maintain a steady output of eggs on to their pastures. The topography of the land hinders natural drainage, and areas of clay soil retain the moisture. Such conditions are conducive to outbreaks of fluke disease, but whether these materialize depends on the climate. The following table shows the degree of variation in wetness which has occurred during the period 1920–1956.

Year	May	June	July	August	Sept.	Oct.
1920	W	W	W	W	W	W
1923	D	D	W	W	W	W
1925	W	D	D	D	W	W
1929	W	D	D	W	W	W
1933	D	D	D	D	D	W
1936	D	W	W	D	W	W
1947	W	W	D	D	W	W
1949	D	D	D	D	W	W
1954	W	W	W	W	W	W
1955	D	W	D	D	W	W
1956	D	D	D	W	W	W

W = wet D = dry

Forecasting epidemics

It will be seen that September and October are nearly always wet, so that there need only be one other wet month in each year to maintain the cycle. This constant wetness of September and October makes it possible to predict the occurrence of fluke disease with some degree of accuracy. Thus if August is wet, the infection will be reaching maturity in the snail towards the end of October. Perhaps a little will pass on to the herbage at that time, but most will overwinter in the snail. Should May or June of the following year be wet, then a dangerous infection on the herbage will result, and some losses can be expected in August and September. If July and August are wet, then the infection can be expected to pass on to the herbage at the end of September, and throughout October, and it is probable that losses will occur from November to February. Severe outbreaks of the disease can be expected to occur after summers such as those of 1920 and 1954; no disease would be encountered after summers like those of 1933 and 1949. We are at present analysing the climate in some detail, and correlating it with the incidence of fluke disease in certain areas, our object being to forecast the occurrence of severe epidemics.

Present control measures leave much to be desired, in that the farmer has to take major steps to prevent stock becoming infected each year, although it is well known that outbreaks of acute disease in sheep occur only in certain years. It is in this respect that the forecast system will be useful in giving some warning of a coming serious epidemic. The application of copper sulphate at times when the infection in the snail is at its highest, but before it has passed on to the herbage, will be a useful aid. In the absence

of the rabbit, it may be possible to suggest methods of management which will enable uninfected fields to be grazed. For instance, fields under hay and corn which are not grazed until mid-August will have little infection on them throughout late autumn and winter, even if the summer is wet. The use of such methods of control, together with the well-tried remedies of drainage and routine dosing, will be an improvement on the present approach to the control of liver fluke disease.

Keeping Deep Litter Dry

F. D. SMITH, D.SC., A.M.I.MECH.E.
Teddington, Gloucester

The condition of deep litter need not deteriorate even in damp, cold weather if the fowl-house is adequately heated.

IN our moist climate, heat is the key to the management of deep litter, for only by the application of heat can the surplus water be evaporated to the ventilating air. The vital fact is that the natural heat of a deep litter house, made up of the body heat of fowls and the fermentation of litter, hardly suffices for this purpose, so that litter tends to cake and become slimy during those unpleasant spells of cold, damp weather which afflict us during the winter, especially in January and February. At such times, conditions in a deep litter house deteriorate, and only the end of the damp, cold spell, bringing a healthy flow of dry air, averts some serious setback to the health and productivity of the flock.

A typical deep litter house, 60 by 20 feet, accommodates about one ton of fowls, for example 400 layers, which eat about 1 cwt of food and drink about 16 gallons of water daily. If the litter is to remain dry, the whole of this water must be taken out of the house as water vapour by the ventilating air.

As engineers and physicists know very well, a great deal of heat is needed to evaporate water. Practical farmers can also appreciate this point by considering the problem of bringing two churns of water, each holding eight gallons, to the boil and continuing boiling until all the water has gone.

Four sources of heat

This very large amount of heat must come from some or all of the following four sources:

Food consumed by the fowl. Heat is produced in its digestion, which sustains the body temperature and evaporates water in the bird's breath and from its feathers.

Litter. The heat of fermentation evaporates water from the litter.

Ventilating air. Relatively dry air, in taking up moisture, gives up heat.

Supplementary heat. Artificial appliances such as electric heaters, oil stoves or hot-water pipes supplement the natural heat of the house.

Deep litter management can therefore be seen as a *thermal* problem. This approach is, as I hope to show, illuminating and fruitful.

Consider the details of the best practice in deep litter management. Thermal insulation is recommended for walls, ceiling and even the floor, to conserve the natural heat of the house. Ventilation is thoroughly planned to replace air, laden with moisture, by a drier air from outside. This dry ventilating air has a dual effect—it provides oxygen for the fowls and it provides heat (by a fall in its temperature) to evaporate water. Finally, deep litter is built up in late summer, to establish a slow fermentation before cold weather begins; and here again, fermentation heat plays its vital part.

These recommendations are practical when the flock is housed in a building specially designed for deep litter. Such buildings are costly, and some poultry farmers doubt if the profit from eggs or table fowls is high enough to justify the capital investment. They have preferred to experiment with the deep litter system in converted farm buildings. Some of these conversions have succeeded, except for brief periods when, because of damp weather or other circumstances, the condition of the litter causes some anxiety about the health and productivity of the flock. Other conversions have definitely not been successful; the litter has not "worked" properly but has degenerated into a compacted slimy mass, on which the dejected flock pads around with cold feet and soiled feathers.

During the greater part of the year, the natural heat of a deep litter house (body heat of fowls and fermentation heat of litter) combined with the drying action of ventilating air suffices to remove all the water that goes into the house. Inside the house, water vapour appears in the air breathed out by fowls, by evaporation from their feathers (the feathers of a hen usually hold several ounces of moisture), and as moist air rising from the warm fermenting litter. Dry ventilating air easily takes up this water vapour, and provides such additional heat as may be required to evaporate any water still remaining in the litter.

When a housewife can dry her washing on a line, the poultry farmer can dry the litter in his deep litter house. When the air is cold and full of fog, the housewife must resort to artificial drying and the poultry farmer must conserve the natural heat of his deep litter house, hoping that by careful control of the ventilation the litter will be kept dry. Usually he restricts ventilation to conserve warmth, but the result can be a stuffy atmosphere, overcharged with carbon dioxide, in which the fowls become lethargic.

Cold weather does not always give trouble with deep litter. Dry cold air, even with many degrees of frost, can take up water vapour. The housewife knows that damp washing hung out during hard frost first becomes stiff as it freezes, then gradually softens as the ice sublimes out of it. Similarly, snow lying on the ground gradually disappears by sublimation, though the frost may not have broken.

In districts of high rainfall, prolonged periods of cold, wet weather are inevitable, and during these ventilating air has no drying power whatsoever. No manipulation of the ventilation, no forking over of wet litter, can then

have any useful effect. There is only one remedy for such a situation: the natural heat of the house must be supplemented by artificial heat. The practical question is how much supplementary heat is needed.

How much heat?

In round figures, we know that about 1,000 British Thermal Units (BTU) are required to evaporate one pound of water. But it is not enough merely to evaporate the water. The ventilating air must be able to take it up. Saturated ventilating air cannot take up any more water vapour unless it is first unsaturated by heating it. This requires a further substantial amount of heat. To calculate this, we need the following table, which shows how much water can be held by saturated air at various temperatures:

Temperature (degrees F)	*Pounds of water (per 1,000 cubic feet of air)*
0	0·068
10	0·110
20	0·175
30	0·278
40	0·410
50	0·583
60	0·823
70	1·140
80	1·570

Note how much more water vapour air can hold as it warms up. If air is warmed from 30°F to 50°F, its capacity to hold water vapour is more than doubled! Thus if 1,000 cubic feet of air, saturated at 30°F is warmed to 50°F, it can take up an extra 0·305 lb of water vapour (0·583–0·278).

The amount of heat needed to warm this air by 20°F is easily calculated. It works out at 367 BTU (1,000 cubic feet of air weighs 76·5 lb; the specific heat is 0·24; therefore the heat required is $76{\cdot}5 \times 20 \times 0{\cdot}24$: that is, 367 BTU). Since the warmed air can take up another 0·305 lb of water vapour, it requires nearly 3,300 cubic feet to take up one pound of water vapour, and this needs 1,200 BTU.

It becomes clear that to get one pound of water out of a deep litter house in foggy weather, when the temperature outside is, say, 30°F, quite a lot of heat is required! About 1,000 BTU are needed to vaporize it; then an additional 1,200 BTU are needed to warm the ventilating air so that it can take up the vapour.

But this is a theoretical minimum. Heat is not used with such precision in the conditions that obtain in a deep litter house: for many reasons, much more heat is required. The above calculation assumes that the ventilating air becomes completely saturated, but this would take too long. The nearer air approaches to saturation, the more slowly it takes up water vapour. The primary purpose of this air is to enable fowls to breathe, and therefore constant replenishment of fresh and extraction of used air are essential. Again, the ventilating air cannot be circulated inside the house so perfectly that every cubic foot takes up its full quota of water vapour. Besides, there are unavoidable losses of heat through floor, walls and ceiling.

Obviously, many times the theoretical minimum heat (2,200 BTU) is

needed even in a specially designed and well-managed deep litter house to get one pound of water out during cold, wet weather. In an extemporized deep litter house, the waste of heat is even greater.

Is natural heat enough?

The problem can now be simply stated. The natural heat of the house must derive, directly or indirectly, from the combustion of food by digestion in the fowls and from fermentation of droppings in the litter. (In a true deep litter system, no litter is added after the bed has been established and is "working".) Now, in rough numbers, only about one pound of food is available to provide the heat to clear one pound of water from the house. So the question is reduced to this: can the combustion, through biological processes, of one pound of poultry food provide, not only enough heat to evaporate one pound of water, but also enough heat to warm the ventilating air to take up the resulting water vapour in cold, wet weather?

The food is a complex ration and we can only guess at its calorific value, considered as a fuel to be burnt in the digestive process in the fowl. Its bulk is carbohydrate, up to 10 per cent can be fat, and the rest is mainly protein, with some small mineral vitamin and antibiotic additions. The following table, which gives the calorific values of some fuels, provides a rough idea of the orders of magnitude involved:

Fuel	*Calorific value in BTU per lb*
Wood shavings	8,000
Peat (dry)	9,500
Anthracite	15,000
Fat	17,000
Oil	18,000

But food is not completely burnt by digestion in the fowls and fermentation of droppings. From one-third to one-fifth of it is retained by the fowl, to meet the needs of eggs, meat or feathers.

It seems difficult to escape the conclusion that barely enough heat is available to get rid of the drinking water, even in the most favourable conditions, during cold, foggy weather. If conditions are unfavourable, as, for example, in improvised deep litter houses in districts of high rainfall, it seems impossible that the natural heat of the house can suffice.

Poultry farmers in low rainfall areas who have well-insulated deep litter houses and manage them well, do succeed in maintaining healthy conditions, even during cold, damp weather. Their dry litter can absorb much moisture before its condition deteriorates, and this reserve storage capacity will tide over a period until a cold, wet spell ends and drier air speedily removes the excess water.

Conditions in the converted house may be adverse. The natural heat of the house may be lost, the litter cools, its fermentation ceases and it may be difficult to get it started again. But there is a remedy. Wood shavings, peat or straw—the usual litter—have a useful calorific value. The natural heat of the house can therefore be constantly supplemented, if litter is regularly and generously added. Where suitable litter is freely available and where, moreover, a big accumulation of litter is welcome for its value as humus and

fertilizer, this is the cheapest source of supplementary heat. If litter is regularly built up to a depth of several feet, a flock can be kept in comfort, even in an open-fronted shed. This is not conventional deep litter, but rather a reversion to old-fashioned farm practice. It is none the worse for that. Calves have long been wintered in loose-boxes with straw constantly thrown under them, until by the spring, their backs scrape the roof rafters and they can hardly get out of the door! Such deep straw makes a warm bed, the temperature about 18 inches down being 60–70°F even in sub-zero weather.

Supplementing natural heat

Where such lavish use of litter is not desired, and a true deep litter system is being followed, with little or no addition after the bed has once been established, cold, wet weather can be countered by supplementary artificial heat. The modern electric fan-and-heater is admirable for the purpose. It warms and circulates the air, bringing warm air from the roof down to litter level. It is worth noting that one unit of electricity (a kilowatt-hour) supplies 3,413 BTU at a cost of a fraction over 1*d*. A fan heater of only 1 kilowatt, running continuously at a cost of about 2*s*. 6*d*. a day should therefore take care of a flock of 100 fowls. This supplementary heat is required only in the emergency of prolonged cold, damp weather, while at other times, the fan without the heater keeps the air in motion at trifling cost. Hot-water pipes, heated by an external boiler fired with coal, coke or oil, are an economical alternative for the large flock. Oil stoves, burning inside the house, suffer from the disadvantage that they consume air, and so require more air changes, involving loss of heat.

The problem of keeping deep litter dry is, therefore, not the same for low rainfall districts as for high rainfall districts.

In areas of low rainfall (for example, on the east coast and in the Midlands), deep litter can be kept dry by conventional good management. Wet, cold spells do not last long, and the litter can hold the moisture that accumulates until dry weather comes.

In districts of high rainfall (for example, Wales, the south-west and the Lake District), supplementary heat is essential. Prolonged spells of cold, wet weather are to be expected, during which the natural heat of the house cannot keep the litter dry.

Blenheim Estate

J. R. LEE, M.A., B.SC., N.D.A.
Agricultural Land Service, South-eastern Region

Blenheim Palace was built for a national hero, has since been the birthplace of another (Sir Winston Churchill), and the house and gardens are themselves part of our cultural heritage. But in this article Mr. Lee concentrates on the management of the estate.

THE Blenheim estate was constituted under a grant of Queen Anne to John Churchill, the first Duke of Marlborough, in 1702. Ten generations have since occupied the Palace, which is reputed to be the largest house in the country and to have cost more than £300,000. The buildings and courts occupy about 7½ acres and the surrounding park is enclosed by nine miles of dry stone walling. Even at the outset the maintenance of such a property must have been an almost insuperable task, involving quite an army of workers. Today, without outside resources, it would be impossible; for example, the bill for puttying the thousand windows, before painting, alone runs into three figures.

The agricultural estate, which is managed from the estate office at Blenheim Palace, lies mainly to the north and west of Woodstock on the Cornbrash soils which border the limestone of the Cotswolds. The river Evenlode, which meanders through the estate in a wide, pleasant valley, provides some well-watered summer pastures. In contrast, the arable land on the slopes and hills tends to dry out in the summer and calls for light land farming. The farming used to be of the traditional sheep and barley variety, but to meet the difficulties of the inter-war years and more recent demands, it has now changed beyond the recognition of former occupiers. Milk cows, grazing sheep, pigs and poultry have replaced the folded sheep flocks and yard-fed cattle. The eighth Duke was a keen stock-breeder and farmer, and he did much to promote the high farming which was prevalent on all progressive landed estates during the nineteenth century. The ninth Duke was also an enthusiastic farmer and stock-keeper and, until the agricultural depression of the 1920s, farmed the Park Farm and a number of others, with great successes at stock shows and sales. During part of this period William Gavin (later Sir William) was his farm manager.

The agricultural land at Woodstock now extends to about 11,500 acres. Besides Park Farm, which is in hand, there are 45 holdings varying from 15 to 750 acres, occupied by 42 tenants. At the beginning of the century the estate was over 19,000 acres, but under pressure of the economic difficulties of the early twenties, high farming had to be abandoned and many farms were sold or let.

Development of the modern system

Before turning to the current problems involved in the management of the estate, it is interesting to trace the history of the farming of the land in hand. The rather light, shallow and free-draining soils of the Cornbrash

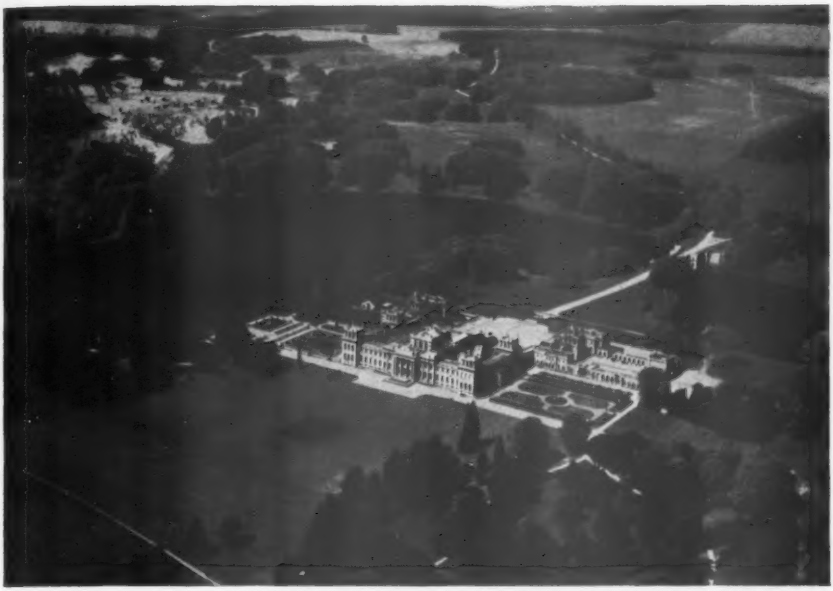


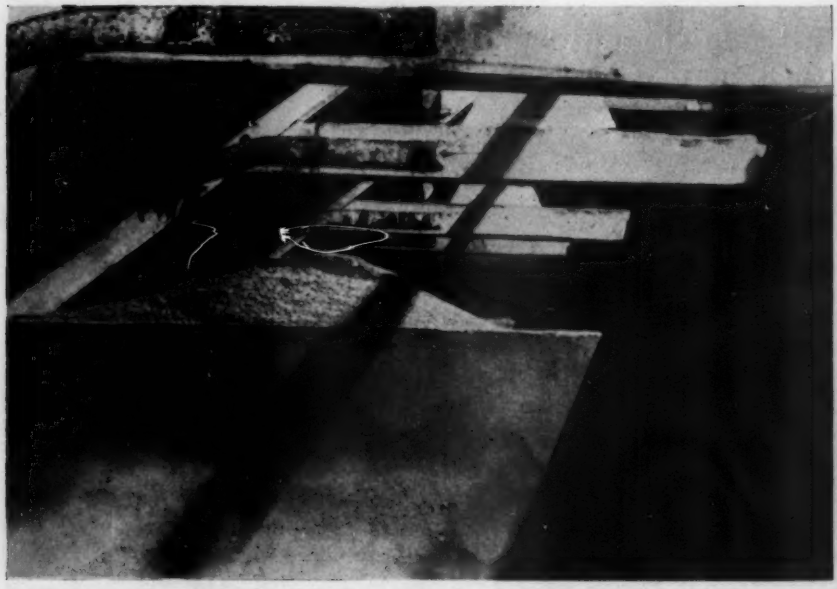
Photo: *Aerofilms*

The Palace in its park—one of the most beautiful in the country.

Photo: *Mustograph*

A glimpse of the Palace from the park.

This 350-year-old cottage has been enlarged and modernized with the help of improvement grants under the Housing Acts.



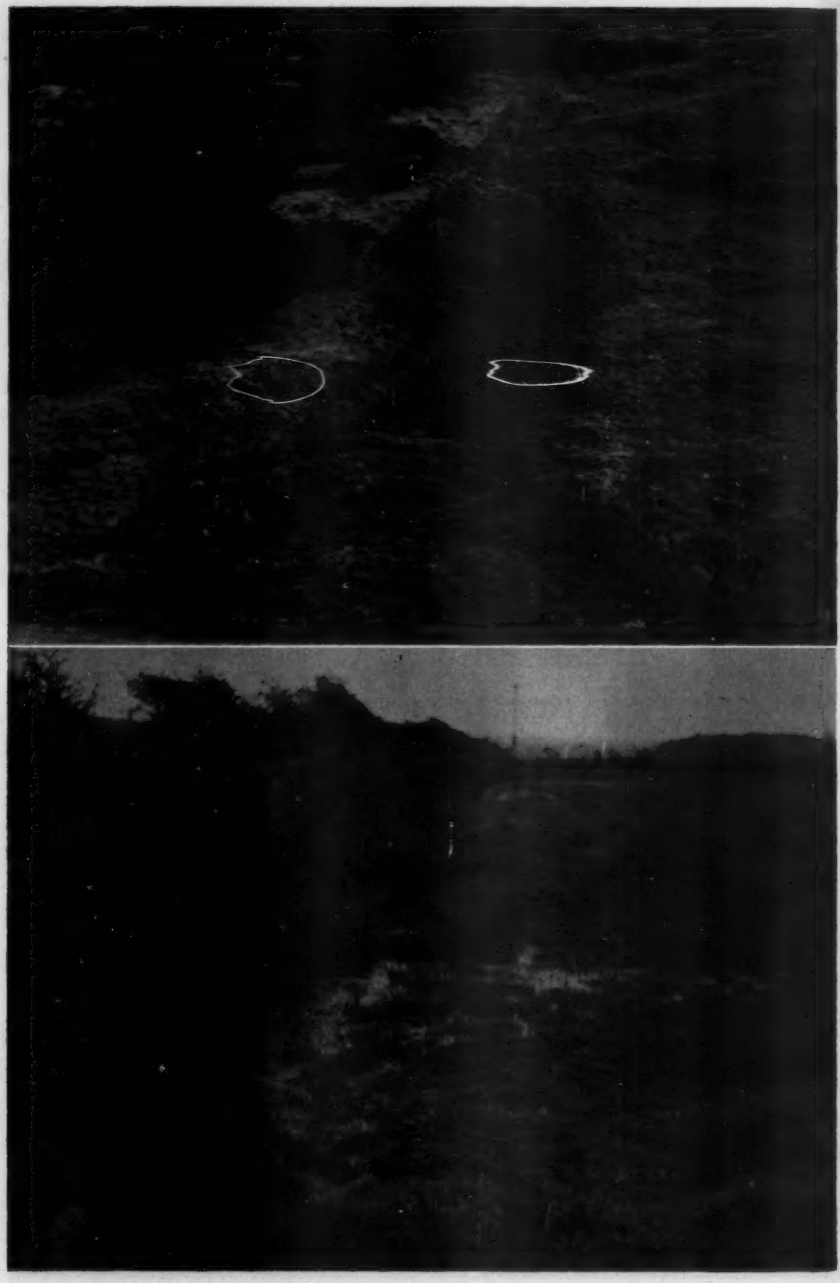
One of eight 25-ton ventilated corn bins. The original loose boxes were divided and strengthened with ties through the 24-inch thick walls.

Cheaper Wintering for Beef Cattle (Article on pp. 219–23)

A portable weighing machine is much better than the eye for assessing efficiency of various feeding systems in beef production.

Photos: *A. J. Brookes*

Outwintering beef cattle take their silage from a clamp in the open.



Typical habitats of the liver fluke: a mountain flush (*above*) and the overflow from a blocked ditch (*below*).

were well suited to the Norfolk four-course rotation and the winter folding of heavy Oxford Down sheep. Corn growing necessarily involved the keeping of yarded cattle for treading the straw. Large joints of fat beef and mutton were in profitable demand and labour costs were low. Although milk production started to expand in Oxfordshire before 1914, it did not penetrate to the arable farms until some years after the end of the first world war, when the high cost of labour for the production of winter fodder for sheep flocks and yarded cattle made these practices unprofitable.

For a time after the farming slump in the late 'twenties and early 'thirties, the management of Park Farm was given to one of the tenants and the land was used mainly as rough pasture—a reflection of the local misgivings caused by the depression. Immediately before the last war, however, arrangements for ploughing the land within the park were once more afoot, and during the war an intensive programme of food production was centred on Park Farm.

Today the farm has about 550 acres of arable and 750 acres of permanent pasture. One of the chief handicaps to the modern system of farming is the difficulty of controlling the grassland, which consists largely of amenity parkland adjoining the Great Lake. The arable is farmed on a seven- or eight-year rotation, with three- or four-year leys. It seems likely that the future will see the arable acreage extended into the permanent pasture and the leys left down for longer periods. The seeds mixture has been evolved in the post-war years when land which had been cropped to capacity with corn during the war was first laid down. The first mixture favoured consisted entirely of perennial ryegrass and wild white clover. Then cocksfoot was introduced to replace part of the ryegrass, and in turn cocksfoot has been largely replaced with meadow fescue. Recently broad red clover, which has always been a favourite on the light limestone and chalk lands because of its deep rooting system, has been reintroduced successfully.

As the Brash soils can be cultivated easily in the spring, the leys are broken up mainly in February and immediately sown to wheat, which yields up to 6–7 quarters per acre. The later ploughings are sown to barley, and this crop sometimes follows wheat. The third year is devoted to cleaning crops and, besides kale and fodder for the cattle, equal acreages of sugar beet and potatoes are grown.

Cattle, sheep and pigs: one team of stockmen

On the livestock side of the farm, the main feature is the home-bred Hereford-Shorthorn-cross beef herd. Hereford bulls are used on first-cross cows. The cows suckle their own and a purchased calf, which are then run on the aftermaths and wintered out before feeding off on grass at two years. The aim is to sell the cattle off the grass. The calves which are bought in are the first Shorthorn-Hereford cross, and the suckling herd is maintained by keeping the best purchased heifer calves. A few cattle, unfinished on the grass, are yarded, but to minimize labour costs this is being avoided as far as possible.

A flock of 200 Suffolk ewes which lamb in March are kept, and the aim again is to sell the lambs off the grass in the early summer. The flock is maintained mainly on the parkland grazing, plus a little concentrated food.

About 35 Large White cross Wessex sows are kept, and crossed with Large White and Landrace boars. Both stores and fat pigs are produced. An interesting aspect of the farm management is the integration of the stockmen's work. The stockmen are accustomed to all duties, and the same men tend cattle, sheep and pigs. This provides for more free weekends. A small unit of poultry, about 400, is kept in straw yards; a few of the poultry, including turkeys, are fattened to serve the estate.

The success of this new system of farming is reflected in the fact that the cost of farm labour has increased by only about 25 per cent in the last ten years, while the gross sales have increased three times. The main emphasis at present is on improving the output of the grassland by bringing more of it under the plough. There is no attempt to follow past traditions in the production of exhibition fat stock. Whether or not the system of beef production on Park Farm will become widespread remains to be seen. Its chief aim is the reduction of labour costs, and an important and a beneficial result is the heavy treading by the store cattle in the winter of the last year of the ley, in preparation for wheat.

While the difficulties of contending with the changes on the farming front in the last generation have been very great, those connected with the management of the estate have been near to overwhelming. The maintenance of the Palace has only been possible, as is generally known, by the ingenious scheme introduced by the present Duke for public viewing. This has produced an income sufficient to contribute substantially to the maintenance of the Palace, but it has involved the formation of a special staff.

The problem of coping with the necessary expenditure on the agricultural side of the estate cannot be solved in the same way, and the small revenue left, after present scales of taxation, is quite inadequate for the purpose. When economic circumstances forced farmers to turn to milk production, many changes had to be made on the tenanted farms to enable them to conform with the provisions of the Milk and Dairies Act. Since the war there has been considerable expenditure under this heading.

Repairs and improvements

It was decided that a general increase in rent after the war was an unattractive proposition, because of the small taxed net revenue which would result. So an arrangement was made with the tenants for them to do their own repairs as an alternative to increases in rent. But this scheme has not been very successful; many farm buildings badly need repair at the present time. Many of the cottages have been improved by grant aid available under the Housing Acts, and a number of schemes for the improvement of the farm buildings and the provision of services are being prepared under the Farm Improvement Scheme. On one farm the dairy buildings and cowsheds are to be reconditioned to provide a milking parlour and covered yard accommodation for forty cows. On another, lacking modern implement storage, a general-purpose building with up-to-date premises for grain handling and storage is to be provided. Other farms are to have pre-cast concrete-framed buildings of the Dutch barn type which, after a little weathering, fit fairly well into the local landscape of Cotswold stone.

In the main, the cottages and farmhouses are of local stone, and the majority

have the very attractive Stonesfield slate roofs. Despite their age (approaching 300 years) these are very substantial, yet homely and good-looking dwellings, and it has always been estate policy to maintain their traditional appearance as far as possible. In one or two hamlets or detached parts of the villages it has been possible to provide electricity, mains water and drainage.

At Park Farm, loose boxes with lofts over them have been strengthened with ties through the 24-inch thick walls and internal divisions made to accommodate eight 25-ton ventilated corn bins and a drying duct. The pit for incoming corn is under the archway entrance to the yards. Except during the corn harvest, this is covered with sleepers and is passed over by traffic almost without being noticed. The covered yards and the layout of ancillary buildings, constructed very many years ago, still form the pattern which is widely used in new construction today.

Perhaps surprisingly, the farm buildings on many of the tenanted farms, some of them built nearly 300 years ago and none less than about 70 years ago, are proving well suited to reconditioning for modern requirements.

Possibly the most difficult matter which the management has to tackle is the running maintenance on the stone-built farmsteads, particularly the Stonesfield slate roofs and the dry stone walls which take the place of fences on many of the farms. Unless these receive regular attention, they quickly become beyond repair. This work calls for skilled craftsmen, and in the present conditions of employment and costs it can no longer be undertaken as economic estate management.

Thousand acres of woodland

Included in the estate are about 1,100 acres of woodland which, like the farm lands, suffered not only from the inter-war depression but also from the war-time demands on home-grown timber. A woodland staff of eight is kept, and the aim is to thin 30 acres and plant 20 acres annually. It may be thought that this is an insufficient programme—at any rate the thinning of 30 acres—but the work on the crops which are being thinned, because of the inevitable neglect in the war years, has been doubled. Some of the timber put through the estate sawmill at Combe during the war was used in the construction of Mosquito aircraft. This mill, which deals with most of the timber required for the estate, was originally powered by water with an ancient steam engine in reserve; now it is mainly driven by electricity. The new implement shed is built around an estate-grown timber framework.

On the Blenheim estate the management has to be congratulated on its achievements so far, and the hope is expressed that somehow or other the means of maintaining the appealing characteristics of the farmsteads will continue to be found.

The writer is indebted to His Grace the Duke of Marlborough for his kind permission to publish this short account of the Blenheim estate and to his agent, Mr. W. L. Murdock, for much information.

Timperley Early Rhubarb in Kent

ALLAN A. JACKSON, B.SC.
Department of Horticulture, Wye College

Timperley Early is a green-fleshed, red-skinned rhubarb of handsome appearance which may be used for forcing, early production in the open or maincrop production.

LIKE several other important horticultural varieties, Timperley Early was a chance development. It was first observed, as an off-type plant, in a field of the variety Linnaeus, cultivated by a Mr. Marsland in Heyes Lane, Timperley, Cheshire. This ancestral crown was the first of a row near the field gate and, when first noticed in 1915 or 1916, it had been badly crushed by the heavy iron tyres of the carts which brought in the Manchester "night soil", then the most important manure of the Timperley market-gardening district. In the following year the plant was seen to be strikingly earlier than its neighbours. After the third year of growth it was divided into nine crowns: one was given to a neighbouring grower, Mr. Tom Baldwin, who later distributed crowns to other members of the family. The variety remained in the hands of the Marsland and Baldwin families for many years, and proved to be excellent for both forcing and out-of-doors production. In the early days it was known as "Baldwin's". It is interesting that Timperley Early was not found in an old and well-established plantation, where seedlings might have been expected to occur occasionally; it was noticed the second year after planting and thus might possibly have been a bud sport from Linnaeus, which it closely resembles botanically.

It was not until the 1940s that the stock became more widely distributed. It was submitted for trial to the Royal Horticultural Society by the Cheshire School of Agriculture and received a "highly commended" certificate in May 1949. Timperley Early was first planted at Wye in January 1949 as part of a variety collection. This transplanting from a light acid soil in the north-west to the rather heavy alkaline brickearth at Wye in the south-east proved successful, and the variety showed itself to be outstanding there by reason of its earliness, quality and almost complete freedom from bolters.

As a result of this trial, about one-fifth of an acre of Timperley Early was planted in November 1953 on a plot prepared with a light dressing of farmyard manure and 2 cwt of a high potash fertilizer. No crop was taken in 1954, but in December of that year a protective covering of 25 cwt of straw was applied to the plot. This treatment was repeated in succeeding Decembers. The crop does not require much labour: up to the present only three operations have been carried out on the plot after the initial planting and first year cultivations—strawing, pulling and top-dressing with sulphate of ammonia.

The first rhubarb was pulled in 1955, and the table shows the yield and time of pulling for that year and the two succeeding ones.

Yield of Timperley Early under straw at Wye

Plot of 912 sq. yd	1955 Yield lb	1955 Revenue £	1956 Yield lb	1956 Revenue £	1957 Yield lb	1957 Revenue £
February					2112	62
March			1128	53	3697	85
April	2243	49	2257	67	320	8
May	623	13	1222	20	95	3
June	244	3			404	6
Total	3110	65	4607	140	6628	164
Approximate yield per acre	7 tons	325	10 tons	700	15 tons	820

The low returns from the rhubarb pulled in June seem to indicate that under the conditions here no crop should be taken after the end of May. Returns as high as 1*s.* per lb have been received in February: it would be a pity to reduce the weight of early pulling by taking too much off the plot at the other end of the season when prices are down to 2*d.* or 3*d.* per lb.

The Farm Improvement Scheme

Preparatory Work

R. W. SODEN, T.D., F.L.A.S.

THE idea has gained currency that it is a complicated business to apply for a Farm Improvement Scheme grant. This is a fallacy, for if a few simple commonsense rules are followed, the work preparatory to submitting an application is not difficult and a little time and trouble spent at this stage may save many headaches later.

The first step should be to obtain an application form and explanatory leaflet from the nearest Divisional Office of the Ministry of Agriculture. This leaflet will give you an idea of the scope of the scheme and explain in detail the whole procedure for getting a grant: it should be read carefully and then kept for reference until grant has been paid.

The next essential, obviously, is to decide what improvement is needed on the farm. Having decided, the third step is to settle how it can best be made. Here is where many applicants' difficulties begin. All sorts of different building layouts and methods of construction may be feasible, but which is the best? If there is any doubt about this, expert advice should be obtained before going any further. Advice is obtainable from two main sources. The primary source will be a land agent, surveyor, or architect. Land agents, surveyors and architects with a rural practice usually have specialized training and experience in the design and construction of farm buildings. They do, of course, charge a fee for their work and this may be included with the cost of work and submitted for grant.

In addition, the Agricultural Land Service of the Ministry is available

to give applicants, and their professional consultants, free advice in broad outline on the most up-to-date design and layout of all forms of fixed equipment. Those requiring advice from this source should not expect to be provided with detailed plans, specifications or costings, the provision of which is the function of the land agent, architect or surveyor in private practice. It must be emphasized, however, that whilst the A.L.S. will continue to give advice in general terms whenever it is possible, the pressure of work in dealing with Farm Improvement Scheme applications for grant is so heavy that the facilities and time available for advisory visits are necessarily curtailed at present.

Fixed Equipment of the Farm leaflets

As well as advice from the two sources already mentioned, much useful information can be obtained from the series of nearly forty advisory leaflets in the Fixed Equipment of the Farm series which are published at very moderate prices by the Ministry. These leaflets cover practically every aspect of farm buildings and other fixed equipment; each is written by an author with practical experience of the subject dealt with in the leaflet; nearly all of them contain useful plans; many are illustrated with photographs. Wider subjects are dealt with in bulletins in more detail and more discursively than the leaflets: both leaflets and bulletins may be obtained through any bookseller or from H.M. Stationery Office. In addition, there is available a series of typical plans of most types of farm buildings. These plans, which are free on application to the Divisional Land Commissioner, may, of course, need some adaptation to fit particular needs.

Having decided on layout and design, the applicant can get ready to complete the application form. The Ministry will need to be satisfied that new buildings and other fixed equipment will meet certain minimum requirements relating to quality of materials and soundness of construction. If there is any doubt about what these are, it is best to ask the Ministry's Divisional Office for particulars before all the details of the proposed work are finally settled.

Tenants who wish to apply for grants must obtain their landlord's consent to the proposed improvement. If a tenant makes a long-term improvement without consent he will have no right to compensation for it on quitting. Equally, the Ministry must be satisfied that the improvement will remain on the land after the tenant quits. If a landlord refuses consent unreasonably, or gives consent on conditions the tenant considers unreasonable, the tenant may apply to his County Agricultural Executive Committee for the Minister's consent. But it should be noted that the Agriculture Bill now before Parliament contains a provision for transferring this function of the Minister's to the Agricultural Land Tribunal. It is best to apply for the landlord's or the Minister's consent before the preparatory work has progressed too far, because the tenant may find himself faced with a request for an alteration or modification of the proposals. If consent has been received the actual letter or form of consent should be sent with the Farm Improvement Scheme application; it will be returned later. Failure to send it with the application may mean delay.

When the application is sent to the Ministry's Divisional Office it will

be necessary, in the case of buildings and similar works, to send with it scale plans including a block or site plan of the existing buildings; but if it is proposed only to erect a simple building such as a Dutch barn, a sketch plan showing the essential dimensions of the building and its components will do. In addition, if a grant is wanted based on the actual cost of the work a specification must be sent with the applications; the Ministry does not need a specification if it is proposed to claim a grant on the standard costs system, because the work must then be done to a standard specification prescribed by the Ministry, particulars of which will be found in the leaflet which will be sent to applicants. The next stage, therefore, is to draw up the plans and, if necessary, a specification.

Here a word of advice will not be out of place. It is a wise man who knows his own limitations. The preparation of plans and specifications is a skilled job for the expert and it should be left to him to do. Some frustration has been suffered by applicants who, without having the training and knowledge, have submitted their own plans and specifications to the Ministry, the result often being lengthy correspondence in an attempt to fill in the gaps and elucidate the details. It will save time and trouble to give this work to a land agent, surveyor or architect to do; his fees for this may be included in the cost of work for which grant is payable.

Bye-laws and planning consent

Depending on the kind of work it is proposed to carry out and the siting of any new buildings, it may be necessary to obtain the consent of the Local Authority under their bye-laws, and also planning consent. It is wise to find out about bye-law and planning consent from the local Council Office before the application to the Ministry is made, because if such consents are needed, they will have to be produced before the grant is paid.

If a grant on the actual cost of the proposed work is applied for (instead of on the standard cost) and it is not intended to carry it out with farm or estate labour, the next step is to obtain competitive tenders (based on the scale plans and specifications previously prepared) from building contractors. If possible three tenders should be obtained; the Ministry recognize that this is not always possible and they will be satisfied with two, or in some districts where there are few contractors, or in other special circumstances, one tender. It should be stressed, however, that it is in the applicant's own interest to obtain as many tenders as possible, as there is often a wide disparity between one builder's estimate and another's for the same job of work.

If it is proposed to carry out the work with farm or estate labour on actual costs or under the standard costs system, it is unnecessary to obtain tenders. In the former case all that is needed is to give an estimate based on the cost of labour and materials on the application form; in the latter case the appropriate column of form F.I.10A (which will already have been received) should be completed and attached to the application form.

If the procedure outlined has been followed the application will then be ready for sending to the Divisional Office of the Ministry, together with the plans and other documents mentioned.

A final warning: the application should be not delayed until a few days

before it is intended to start the work. Thousands of applications have been made and, while every effort is being made to deal with them as quickly as possible, it may take a month or more for an inspection to be arranged and a decision given. And no work should be started before *written* approval has been received, or else the grant will not be paid.

Bristol Royal

JOHN L. JONES

THE Bristol Royal spread its promise over the 136 acres of the Whitchurch airport under a warm pall of low-lying cloud. Rain never seemed very far away but, apart from a few showers and one freak evening rainstorm—minatory reminder of the flood-and-mud holocausts of the north—the the weather held and rubber boots were confidently left in the car park.

Suitably gracing the Grand Ring, the horses were judged on the opening morning, perfect magnificent reminders that at the last Bristol Royal (in 1936) most of our farm horse-power was on legs. Now it is all on wheels and the tractor and machinery avenues dominated and dwarfed the livestock lines.

But what to see first? Farmers from the great rhine-and-ditch mid-Somerset plain were deeply interested in the ditching machines. Essentially, to date, the ditching equipment in the farmer's price and power range is for the maintenance of wet ditches, and reclamation or new cutting is still a contractor's task. This was still the trend of this year's display.

An enormous array of silage—and haymaking—machines was dominated by yet bigger forage harvesters. These were coupled, in many instances, with self-loading trailers to pace the faster field pick-up of bigger machines with faster unloading at the pit. Balers, too, were bigger, with outputs for "blitzing" the grass of our catch-as-catch-can haysels. Forced air drying through the bales attracted attention from the haymakers.

More generally, the machinery theme was the multiplication of muscle-saving uses of power in all the field and farmstead chores—front- and back-end hydraulic lifts for combined corn sacks, hoists for bales and other produce and—an eye-catching machine—mechanical mucking-out of the byre. The approach to increased versatility and hours of work from the same machine was well exemplified in a muck spreader which, by simple modification, became a self-unloading trailer for silage crop harvesting.

The greenest spot in the whole Show was made up of the miniature swards of the Ministry of Agriculture's exhibit, where all-the-year-round feeding of sheep was demonstrated. Sheep and grass are a compulsive pastoral couple and with the ingenious side creep feeding control for lambs from Hurley, drew probing crowds. So did the demonstrations by Miss Heather Torrance, billed as the world's fastest woman shearer though operating here not as a speed virtuoso but as a Bowen-trained exponent of the advantages of New Zealand woolmanship. Miss Torrance's flowing strokes and her easy control

of massive Halfbred ewes with her moccasined feet and gripping legs were a joy to watch, and drew many sheepmen to the stand for instruction.

As a Show, the Royal is perhaps less dominated by the economic element than is an event such as Smithfield. The arithmetic of farming is here but there is also ample scope for the gleam in the stock-breeder's eye. The beef cattle in particular were good to look at; in the opinion of many, the dun Galloways, with coats like Palominos, took the aesthetic Blue Riband. Highlight of the beef cattle judging was the eclipse of all-conquering "Vern Inspiration" by the Royal Highland Champion, "Lanham Proctor". Whereas dairy entries were down, beef cattle were up, with 94 Aberdeen-Angus, 73 Shorthorns, 58 Galloways, 14 "Belties" and 19 Highland.

Cluns and Suffolks led numerically in the twenty-nine sheep breeds. Swine fever restrictions affected pig numbers but, as expected here within close reach of the Severn Vale, there was a strong contingent of Gloucester Old Spots, the native breed of Double Gloucester cheese and cider country. The Landrace, now an established British white, made its Royal début.

As is customary on these occasions when town and country meet and mingle, there was plenty of spectacle. Highlight of the Grand Ring was a kaleidoscopic pageant descriptive of a Beaufort Hunt in 1840 and of a Country Fair; and a fascinating collection (or should the collective noun be "pride"?) of veteran cars was a good second.

The educational element was well to the fore. The wool tent, which featured British fleeces of all shades and qualities from the Black Welsh Mountain through the grey Gritstone to the whitest Dorset Down, drove home the do's and don'ts of good woolmanship. Pre-packaging techniques (over 200 million pre-packs are now being sold each year), the use of portable sheep handling and shearing pens, an impressive exhibit of polled cattle and sheep, the Ministry's story tableaux of the plan and growing prosperity of the Gloucester "Manor Farm"—these and many other educational exhibits and demonstrations offered food for thought—and a rest for tired feet!

Her Majesty the Queen Mother spent six energetic and interested hours at the Show on the Wednesday.

The layout at Whitchurch was exemplary. The wide tarmac of "Fifth Avenue" was appreciated by everyone; and this, coupled with the adverse financial results of the Show, must have brought the issue of a permanent home for the Royal into critically sharp focus.

Farm Safety

MEGAN HOOLEY, B.SC.(ECON.)
Ministry of Agriculture, Fisheries and Food

WORKERS in factories and in the mines have for many years been protected by law from the hazards of their occupations. Nothing similar has existed for agriculture, and when the 1937 Factories Act was going through Parliament some people urged that it should be extended to cover the farming industry.

But although some of the risks were similar, and it was clear that something should be done, the differences in circumstances were so great that the Government decided factories legislation would not be appropriate to agriculture. Then came the war. Welfare work had to take a back seat for a while; but there was a great increase in the use of machines on the farm and in the risks to people using them.

By 1946, a special committee had been set up under Sir Ernest Gowers to inquire into conditions of work in places not covered by the Factories or the Mines and Quarries Acts. One of the conclusions of that committee was that a Bill of more limited scope than the Factories Acts should be brought in to give the agricultural worker protection. This part of the Report was generally accepted, but although the special dangers from crop spraying were dealt with in the Agriculture (Poisonous Substances) Act in 1952, it was not until 1956 that the wider field of general safety was covered by the Agriculture (Safety, Health and Welfare Provisions) Act.

The Act is, in the main, an enabling measure. Although in one or two sections specific subjects are singled out for attention—for instance, provision of first aid equipment and the protection of children—the Act's principal part is the first section, which gives powers for the making of regulations:

> "protecting workers employed in agriculture against risks of bodily injury or injury to health, arising out of the use of any machinery, plant, equipment or appliance, the carrying on of any operation, the use of any process or the management of animals, for securing to such workers safe places to work in and safe means of access thereto and for protecting them against risks of bodily injury arising out of their falling through apertures in floors or walls, or from their work-places, or while ascending or descending staircases or ladders."

Thus Parliament said in effect that many of the practical problems needed closer study and consultation with the interests concerned, but that the powers were now available to legislate for safety. Of course, when powers of this general nature are delegated, Parliament has to keep a close watch on the way they are used and regulations under this section have to be debated in draft by each House before they become law.

Ladders and P.T.O.s

Two sets of regulations have already been made under the comprehensive Section 1. One deals with ladders and came into force on 1 November 1957; the other concerns power take-offs and power take-off shafts and becomes effective in three stages—1 August 1958, 1 February 1959, and 1 August 1959. This is not the place for a detailed description of the precise requirements of regulations, and, in any case, they are all separately explained in short leaflets (see the list at the end of this article). But it may be useful to examine a little closer the Ladders and P.T.O. Regulations, as each is an example of a rather different type.

Faulty ladders, especially when they are used under farming conditions, can be very dangerous. The problem is not only to see that they are right to begin with but also to make sure that they are not allowed to deteriorate. A good employer will keep his eye on all his farm equipment, but he cannot

always know what is happening to the portable ladders used by his workers. With these difficulties in mind, the Ladders Regulations were framed so that employers have to see that the ladders provided are (and remain) sound; workers and employers have joint responsibility for the use of ladders (for instance, not using one which is inadequate for a particular job even though it may be quite good enough for others); and workers must tell employers if they find that a ladder they have to use has a cracked rung or some other specified defect. Ladders are comparatively simple things and, since the regulations focus on safe use as much as safe equipment, it was not necessary to allow a long period before the regulations were brought into force. Three months were given for publicity and for employers to put their ladders in order.

Power take-offs were less straightforward to deal with; but they are the cause of many serious accidents. Here again, the machines concerned spend much of their life out of sight of the employer, and so it was decided to lay part of the responsibility on the worker as well. The employer must not "cause or permit" machines that do not comply to be used, but at the same time the worker must not use such machines. Although the requirements laid down in the regulations are simple, they involve the adaptation of existing machines and modifications to some new ones. That is why there are three dates of operation and why even the first of these came twelve months after the regulations were made. The easiest thing to deal with—the p.t.o. shield on new tractors or on tractors designed to take such a shield—is legally necessary from August 1958: the most difficult—safe guards for machines in use—have a further twelve months and do not have to conform until August 1959.

Further regulations are in preparation concerned with such matters as circular saws and other machinery, safer work places and maximum weights.

Framing legislation

The basic procedure is much the same for all these safety regulations. The inspectors produce a "blue-print" that would meet the particular case from their point of view. This is then referred to any officials who may be concerned in one way or another, and as soon as a set of proposals taking account of their comments can be produced, it is circulated to all appropriate organizations. Naturally there are some, such as the N.F.U. and the workers' unions, who have a close interest in them all. Others will be keenly interested in, perhaps, the first aid proposals, but have no concern at all with the guarding of circular saws. The list of representative bodies who were consulted about the Children's Regulations included a wide cross-section of the community. Once all these organizations have been consulted, their views have to be considered and a balance struck between those who want more restriction, those who want less and those who want something quite different. All the regulations made so far have applied equally to Scotland as well as to England and Wales, and therefore the Department of Agriculture for Scotland has been closely associated with the Ministry at all stages.

Are all these new restrictions really necessary? Even allowing for the fact that some 150 people are killed and thousands injured on farms every year, it might be asked whether it would not perhaps have been better to rely on

advisory work to make people safety-conscious. It is true that a lot can be done by education; and the majority of farm activities cannot be governed by the precise formula that the law requires. But there are obvious danger spots where it is perhaps an inconvenient nuisance to guard a machine, or to make sure that equipment is kept up to standard, and unless a legal sanction supports the minimum required for safety, there is a strong temptation to shelter behind the thought that "it won't happen to me"—until it does!

The Act and commonsense co-operation

The Safety Act is the spearhead of the attack on things that cause injury and death on the farm, but it is not the whole campaign. For one thing, the greater part of the Act itself is limited to farms where workers are employed, but any sensible farmer will realize that standards laid down in these regulations are the minimum for safety, even if he is the only person concerned. Also, in addition to the publicity for safety that the Act brings, there are endless topics outside the scope of legislation that the Agricultural Departments have brought, and will continue to bring, before the farming public by publications, show displays, lectures and films. The safety and wages inspectors are on hand throughout the country not just to enforce the requirements of the law but also to advise and assist on everything concerned with safer working conditions.

However much is done to put safety across, the success or failure of these efforts will depend very largely on the receptive attitude of the people to whom they are directed. There is nothing very revolutionary in any of the measures advocated or prescribed by law. Everyone who stops to think must know that a whirling piece of machinery needs a guard before it is safe, that a tractor cannot be treated as a stunt vehicle and that a bull needs careful handling. Nevertheless, people—experienced people—get drawn into machinery, overturn their tractors, or are injured by bulls. Accidents do not just happen—they are invited. There is no need for a tentative or overcautious approach to the job in hand, but care and commonsense will pay high dividends.

The following regulations made under the Agriculture (Safety, Health and Welfare Provisions) Act are already in force and can be obtained from H.M. Stationery Office or through any bookseller:

The Agriculture (First Aid) Regulations, 1957 (S.I. 1957 No. 940).
The Agriculture (Ladders) Regulations, 1957 (S.I. 1957 No. 1385).
The Agriculture (Avoidance of Accidents to Children) Regulations, 1958 (S.I. 1958 No. 366).

The following regulations have been made to come into force on the dates stated:

The Agriculture (Power Take-off) Regulations, 1957 (S.I. 1957 No. 1386): in stages from 1 August 1958 to 1 August 1959.

Explanatory Notes and *Leaflets* have been issued on the subjects of First Aid in Agriculture, Ladders, Power Take-offs, Accidents to Children, Tractors Overturning, and Bulls. All can be obtained from Divisional Offices of the Ministry or from headquarters (Publications), Soho Square, London, W.1.

Primrose McConnell
and the Agricultural Notebook

PRIMROSE McConnell, the son of a Scottish tenant farmer, had the idea of compiling an *Agricultural Notebook* after studying agriculture at Edinburgh, where he ". . . oftentimes felt the great want of a book containing all the data connected with the subject". To meet this need, he collected notes over a number of years from all the standard text-books within reach and, after due arrangement, published them in 1883 with academic blessing.

He wrote nine or ten text-books on various aspects of agriculture, among which *Elements of Agricultural Geology* (1902) and *The Complete Farmer* (1910) were outstanding. But all agricultural students will agree that there is nothing quite like the *Notebook*, which has now reached its 13th edition.*

My own copy (the 10th edition) has been in the forefront of my library of agricultural books ever since I bought it in the autumn of 1922, and it has accompanied me on my travels to foreign lands. The investment of 15*s.*, which seemed so much on that October day, has been fully justified: I have rarely turned to the *Notebook* in vain.

As the subject of agriculture gets more complicated and involved, so does the problem of providing a notebook become more difficult to solve. Most of us now have to know more and more about more and more, and thus the question naturally arises how effectively this latest edition of the *Agricultural Notebook* meets modern needs. It has been on my desk for about a month, and the longer it stays with me the more I appreciate the mass of detail which it contains. In places, it has perhaps become more of a compendium or encyclopaedia of agriculture than just a notebook, though some of the sections keep pretty closely to McConnell's formula. Even as an encyclopaedia it is unique (there is no other for agriculture later than 1931), but its present form is unfortunate in that it purports to be a summary of existing knowledge, with no recommendation for further reading. Thus it might well be used by the modern student as a crammer rather than as a book of reference.

Although the 12th edition was published only five years ago, the 13th has involved considerable revision; in fact, three-quarters of it has been rewritten. Professor Ian Moore, editor of the last two editions, has had the assistance of a number of distinguished experts, and that in a way causes the book to lose something of its original character, which owed much to its being the work of one man who had what he wanted very clearly in mind.

In the preface to the 10th Edition, McConnell refers to the immense progress made in agricultural practice and science as being "astonishing to anyone who has tried to keep abreast of it". That was written in 1922, and one wonders what phrase he would have used in 1958. But it is satisfying to know that his book conceived three-quarters of a century ago is still received with so much pleasure—even though it now costs 40*s.* and is too big (900 pages) to fit the pocket unnoticeably.

R. EDE.

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* The Agricultural Notebook (13th Edition). Edited by PROFESSOR H. IAN MOORE. Farmer and Stock-Breeder Publications. 40*s.*

Viscount Bledisloe

In his Gloucestershire home at Lydney Park, Viscount Bledisloe, P.C., G.C.M.G., K.B.E., died on 3 July in his ninety-first year. Well loved and deeply respected in many spheres, both in this country and overseas, he will be remembered as an almost legendary figure—an undeviating champion of British agriculture. Buttressing his firmly-held principles by sound practice and enterprising vision in the running of his 4,000-acre Gloucestershire estate, he sought ever to stimulate and promote the well-being of Britain's agriculture, whilst discharging to the full the responsibilities of landownership to which he was born the heir.

Educated at Eton and Oxford, Charles Bathurst, as he was then, very soon showed his great interest in agriculture. He studied at the Royal Agricultural College, Cirencester, for three years, and in due course was awarded the Gold Medal. Later he became Chairman of the Governors, remaining a Governor and taking an active interest in the life of the college right up to the time of his death. Lord Bledisloe also held the Gold Medal of the Royal Agricultural Society of England, of which he was a life member and President in 1946. He was called to the Bar by the Inner Temple in 1892, but it was not until some time later that he thought of entering politics. He was returned to Parliament for the Wilton Division in 1910. During the first world war, he represented the Food Controller (Lord Devonport) in the Commons. He was created a K.B.E. in 1917 and, in the following year, Baron Bledisloe, of Lydney. (Bledisloe was the name of the ancient hundred which included the Lydney Park estate.) From 1924 to 1928 Lord Bledisloe served as Parliamentary Secretary to the Ministry of Agriculture, and in that capacity visited South America and negotiated the Bledisloe agreement, which still governs the inspection of animals for export as meat to the United Kingdom. He was Chairman of the Royal Commission on Land Drainage, which was set up in 1927; the report of this Commission underlies the Land Drainage Act of 1930.

Lord Bledisloe's appointment in 1929 as Governor-General of New Zealand was enthusiastically welcomed in the Dominion; and his term of office there, until 1935, is remembered with personal affection and widespread recognition of the benefit which his indefatigable services brought to the young country.

Apart from his official appointments, Lord Bledisloe was an extremely active member of the leading agricultural societies, holding high offices in the Central Chamber of Agriculture, the Central Landowners' Association (which he had helped to form), the British Dairy Farmers' Association, the Bath and West Agricultural Society, the Lawes Agricultural Trust at Rothamsted, the agricultural research committee of Bristol University, the Royal Agricultural Society of England and The Farmers' Club.

Here was a man who clearly saw his duty to the land and to his country, honoured the discharge of his personal responsibilities to the full, and in countless ways set an example which will long outlive him.

Farming Cameo: Series 2

5. South Cambridgeshire

P. R. PEACHEY, B.SC.
District Advisory Officer

SOUTH CAMBRIDGESHIRE is truly representative of the granary of England. Large farms cover a majority of the acres, and cereals predominate. There are no towns, but the country folk are well served by the neighbouring counties of Suffolk, Essex and Herts, whose market towns of Haverhill, Saffron Walden and Royston are almost on the county borders. Wide sweeps of barley, in some cases more than 100 acres in a field, might, in print, give the impression of a miniature prairie, whereas in fact this is mainly chalk country, of low rolling hills, subtended by the boulder clays of Suffolk and Essex and the heavy clays of west Cambridgeshire. These contours, plentifully broken up by beech trees, coupled with light-coloured soils, contrast sharply with the black, flat, treeless fens in the north of the county.

Farms of more than 150 acres comprise 85 per cent of the area, and farms over 1,000 acres are by no means uncommon. Mechanization has been accepted for very many years; some of the first combine harvesters in Britain were at work here well before the second world war. Grain storage, drying and handling machines have all passed through the teething-trouble stage, and some farmers have had them long enough to be thinking of changing them completely, in favour of yet more modern plant. Most farms over 50 acres have their own combine harvester, and many below this acreage are using secondhand machines. Mechanical harvesting of sugar beet, an important crop in the rotation, has also been accepted practice for many years on practically every farm growing more than 10 acres, and in the last two years mechanical thinning has leapt ahead. The introduction and use of machines in such a progressive manner has not been the result of a shortage of labour, though the labour force in this district declines by about 3 per cent each year. It has rather been due to the fact that the type of farming practised and the nature of the countryside lend themselves to a mechanized system.

The usual cropping sequence is of five shifts, an extension of the Norfolk four-course system; more recently, another barley crop has been taken after wheat, which on many farms means that 50 per cent of the land is in barley. Very fine samples of malting quality are grown, and Proctor now makes up some 75 per cent of the acreage. High yields of wheat are obtained, in spite of the soil type, partly because Cappelle dominates all other varieties to the extent that it comprises 86 per cent of the winter wheat acreage, and partly because of the very high skill in growing cereals. Spring wheat and oats are not much grown, the former because it cannot compete economically, and oats partly because they do not yield so well as barley, and partly because there are more pigs than cattle. A rainfall of 20–21 inches a year is normal, but a run of dry spring months for a few years has helped to drive out these two crops.

In this area combine drills are never entirely packed away for the winter,

and autumn, winter and spring sowing all merge together. "Spring" sowing of barley is reckoned to begin around the second week in December and ends correspondingly early—in time, in fact, for sugar beet to be sown in the second half of March.

Sugar beet is the most important of the change crops, and cultivations appropriate to the use of precision drilling and mechanical thinning are making rapid progress. The tops of this crop are not widely used for stock-feeding, but they do make up in some measure for the lack of dung.

The other change crops are broad red clover, peas and sainfoin, which does very well on these chalky soils, and finds a ready market as hay in the nearby racing centre of Newmarket. But all these crops are becoming increasingly the object of pigeon attack, and therefore farmers are already looking for alternatives. The lucerne acreage has more than doubled since 1951, and herbage seed, though not widely grown, is increasing slightly. In a few areas fallows are still to be found. These are not necessary for the control of perennial weeds, but are usually put in with a green crop, such as mustard or rape and turnips, for ploughing down. White mustard for seed is sometimes taken; so, occasionally, is rape.

A few pioneers now have irrigation, but natural water supplies are not sufficiently plentiful for it to become widely adopted at present.

Only 10 per cent of the area is permanent grass, and this is of indifferent quality; but ley management is good on the relatively small numbers of farms with dairy herds. Non-ryegrass swards, as one might expect in this area, are very much in the majority.

No particular breed of dairy cow is favourite, although pure-bred herds are very much the rule, several being nationally famous. Forage farming is not practicable in an arable area such as this, but the crop by-products of cereals and sugar beet go a long way towards reducing the need for bought-in feedingstuffs.

Sheep outnumber dairy cows by nine to one, and although fifty years ago this was the home of many well-known Down flocks, there are now few close-folded sheep to be seen. Those that remain produce high quality rams for crossing in other parts of the country and, indeed, the world. The number of scavenging flocks are increasing, with the farmer or his foreman acting as part-time shepherd. In the last seven years the sheep population has almost doubled, and recently the Clun ewe, put to a Suffolk or Hampshire Down ram, has become quite popular.

Pigs, which are ten times as numerous as dairy cows, are kept intensively in the majority of cases, providing a useful outlet for the plentiful tail-corn. The Large White and Landrace breeds and their crosses are the most common, but a few pedigree herds of the coloured breeds still flourish.

South Cambridgeshire is not hunting country, and fishing, except in a few small streams stocked with trout, is negligible; bountiful pheasant and partridge shooting however, more than make good those deficiencies in the farming calendar, and the production and protection of these birds provide yet one more gratifying crop.

Farming Affairs

New Parliamentary Secretary

The Earl Waldegrave has been appointed Joint Parliamentary Secretary to the Ministry of Agriculture, Fisheries and Food in succession to the Earl St. Aldwyn.

Lord Waldegrave has been closely associated with the Ministry in recent years, serving as liaison officer to the Minister for Somerset, Wiltshire and Gloucestershire, and is well known as an experienced and progressive farmer. He farms about 1,200 acres at Chewton Mendip, where he breeds Ayrshire cattle and Clun sheep, and specializes in cheese-making.

Lord St. Aldwyn, who became Joint Parliamentary Secretary to the Ministry in October 1954, is now Captain of the Gentlemen-at-Arms.

The future of Covent Garden Market

The reorganization and reconstruction of London's Covent Garden Market were the subject of a recommendation by the Runciman Committee when it reported in January, 1957.* In a statement made in the House of Commons on 11 June this year, the Minister of Agriculture announced that the Government accepts the Committee's view that the market should not be moved, but should be greatly improved in the interests of efficiency, smoother flow of traffic, reduced fire risk and the proper development of the neighbourhood. It is proposed to bring in legislation providing for a statutory Covent Garden Market Authority, but it is not yet possible to say when this will be introduced. When it is set up, the Authority will first of all concentrate marketing in a smaller area by acquiring some of the land and premises at present in market use. Ultimately, it will provide and maintain up-to-date market buildings in the area.

These radical changes will require a review of the original Charter and of existing private legislation, and it will be necessary for the new Market Authority to acquire the Charter Market. The Authority will be given powers to enable it to prevent the present sprawl of the market over too wide an area. As a first step, in order to concentrate the market and to reduce traffic congestion, the Government have decided to provide for storage premises elsewhere. Such new accommodation would then be available to take the bulk produce not required by retailers using the market and for empty containers at present stored there. Pending the establishment of the Authority, the Minister said he hoped to be able to make temporary arrangements for the provision of these facilities by another agency, possibly a local authority.

Parallel with the improvement of the market, the London County Council, as planning authority, will prepare a plan for the development of the whole neighbourhood and submit it to the Minister of Housing and Local Government. The Government have accepted the Runciman Committee's recommendation that the Brentford and Stratford Markets should be developed

* See Cmnd. Paper 61 (1957) and article by R. T. Pearl in the March, 1957 issue of this JOURNAL.

and expanded. This will reduce the number of retailers at present coming into Central London to make their purchases, despite inconvenience and loss of time.

This programme will, in the Government's view, command wide acceptance and make it unnecessary to proceed with the Runciman Committee's proposals for an additional market and for a London Markets Authority.

Replying to Mr. Anthony Hurd, M.P., who asked how long it would take to carry through the plan to rebuild Covent Garden Market, the Minister said that a start would be made on the storage depot as soon as possible. Later stages would include the rebuilding of the market, and that would take some years.

Part-time education

Most agricultural education is given in the form of full-time courses at universities, colleges and farm institutes. But local education authorities, with the support and encouragement of the Ministry, have in recent years been providing more part-time education, particularly day-time classes for which young people are released by their employers.

An interesting report on this branch of agricultural education has recently been produced by the City and Guilds of London Institute. It consists of a summary of information gained by the Institute in a survey of part-time courses in agriculture made during the years 1953–56. The general picture given in the report is that "in the majority of counties the provision (of part-time education for agriculture) is neither sufficiently comprehensive nor large enough in volume, to provide the local industry with a system of technical instruction which adequately covers even the basic aspects of its work. In this respect agriculture differs markedly from most other productive industries". It goes on to say that "the lack of success (of day classes and progressive courses over more than one year) was reported to be due principally to the lack of recognition by most farmers of the value of formal technical instruction as a component of training for agriculture".

There are exceptions to this general picture. In a few counties, a comprehensive and successful variety of part-time and short full-time courses have been established and are operating with close liaison and support from the industry, the N.A.A.S. and organizations such as the Young Farmers' Clubs. "The most striking feature of the survey has been evidence from about a dozen counties that substantial progress can be made in securing the co-operation of the farming community in establishing part-time day classes for apprentices and other young people, and in creating a more comprehensive system of technical education for the industry." A detailed description of the arrangements in a particularly progressive county is given in the report.

It is strongly recommended that the successful developments in this field should be published and made more widely known. A further recommendation is that new "City and Guilds" syllabuses for examinations should be used as a basis for a nation-wide effort to extend and improve part-time education for the industry. Syllabuses for Stage I in Crop Husbandry, Animal Husbandry, and Farm Machinery (Introductory) have just been issued. More advanced syllabuses for Stage 2, which will aim at the level appropriate to a skilled adult worker, are to follow.

Further education for agriculture provided by the local authorities is at present under review by a committee set up jointly by the Ministers of Agriculture and Education, under the chairmanship of Lord de la Warr. This committee is looking at the arrangements for part-time agricultural education, among other things, in England and Wales, and will be making recommendations. Copies of the "City and Guilds" report have been circulated to its members for information.

Copies of the "Summary of Information" and of the Stage I syllabuses are obtainable on application from the Director (C12), City and Guilds of London Institute, Gresham College, Basinghall Street, London, E.C.2.

Frequency of feeding and growth rate of young cattle

In her native state the cow takes her food as and when she likes, but since domestication the regularity of feeding times has been at the discretion of the herdsman. The value of frequent feeds, especially to the unweaned calf and to the fattening steer, has been appreciated and has found its way into general farming practice. There are, however, fewer opinions on the effect of short intervals between feeds on the growth rates of store animals, and this may be of considerable economic importance with animals from six to twelve months old. The results of two trials on animals of this age group are reported below.

Seven sets of identical twin heifers were used in a simple reversal trial of once versus twice daily feeding. One member of each pair was fed for 50 days at the once or twice daily level and then at the end of this period the treatments were reversed. The rations given to each pair were the same and were based on a concentrate mixture, hay and brewers' grains. The mean liveweight gains for the two groups were:

Twice daily—1·33 lb a day. Once daily—1·30 lb a day.

The second trial was designed to exaggerate the treatments, and accordingly a comparison of once versus six times daily feeding was made. Four sets of twins were used here and the plan of the experiment was similar to that used in the earlier trial. The mean growth rates for the two groups were:

6 × day—1·68 lb a day. 1 × day—1·60 lb a day.

Although each trial did show a greater liveweight gain by the frequently fed animals, in neither case was the difference statistically significant.

The result is interesting in that it is in direct contrast to that obtained by workers in the U.S.A.,* where animals of a similar age and weight range did show a significant difference when fed ten times per day as opposed to twice. The liveweight gains were, however, much smaller than those obtained at Shinfield.

10 × day—0·47 lb a day. 2 × day—0·24 lb a day.

In conclusion it can be said that under conditions enabling the animals to grow at a pound a day and over, the extra growth rate obtained by feeding a set amount of food in several meals as opposed to a single feed per day is

* Response of Growing Dairy Heifers to Frequency of Feeding. A. H. Rakes, W. A. Hardison, J. Albert, W. E. C. Moore and G. C. Graf. *J. Dairy Sci.*, 1957, **40**, 1621–7.

very small. However, when the liveweight gain is small a significant increase will probably be obtained by "short interval feeding". It is also probable that where the amount of food is not restricted, then the daily intake can be increased by feeding little and often, and this in turn may affect the growth rate.

Weed-killing from the air

It is risky to spray hormone weed-killers from ground crop sprayers near susceptible crops, because of the danger of drift. For example, MCPA can taint tomatoes, and 2,4-D can deform lettuce.

The hazard is very much greater when aircraft are used, especially fixed wing aircraft with atomisers, for in the small fields common in Britain it is almost impossible to be sure that all the spray lands on the target. The British Weed Control Council emphasizes that aircraft spraying of hormone weed-killers near susceptible crops such as tomatoes, turnips, cabbage, beet, orchard trees (particularly pears) in flower, lettuce and glasshouse crops is a dangerous practice and should be avoided.

The Council also draws attention to the fact that though sodium arsenite efficiently destroys potato haulm and weeds in bulb-fields, it should never be used in other crops. The residues that will be left on the crops are strongly poisonous.

Retirement of W. A. Stewart

It is hard to believe that W. A. is retiring after thirty-eight years as Principal of the Northants Institute of Agriculture at Moulton, for to those who know him he has remained perpetually young. Starting with a handful of students in 1921, he has built up Moulton to what it is to-day, and to him Moulton has been the "only" Institute. Throughout the years he has inspired enthusiasm in all of us, staff and students, for Moulton and its work.

He has always kept closely in touch with the farm, and little which might go wrong has escaped his notice. His great interest has been livestock. He has an amazing memory for pedigrees, and a photographic mind so far as livestock is concerned. He is also a great showman. He was the first person to introduce livestock demonstrations in the form in which they are now well known. The Students' Show at the end of each course is in its way both personal and unique. His commentaries on the parades at national and county shows have been appreciated because they are so essentially subjective, and based upon an intimate knowledge of breeds, breeders and their herdsmen.

However, it is as a principal and teacher that he will best be remembered. He may sometimes have appeared a rather hard taskmaster, for he would never tolerate anything shoddy or second rate, but he always rode lightly in the saddle, and his sense of humour and fairness ensured that things got into their true perspective. Life for those associated with W. A. could never be dull, and a wonderful team spirit continued from year to year. As one ex-student, who subsequently attended two universities, wrote: "Mr. Stewart will always be, to me, one of the 'greats' among teachers." Another has written: "And if 'the true success is to do the common thing uncommonly well', then Walter Stewart showed us how to succeed—at farming."

JANET STRANG

Diseases of sheep

Sheep farming has always played an important part in our agricultural economy and in certain parts of the country it assumes a major role to-day. Like all our domesticated animals, sheep are subject to attacks of ill-health and disease which, in certain seasons, may assume catastrophic proportions. Most of this ill-health arises from the sheep's own environment. Few are introduced infections. The causes are many and varied. Most shepherds are fully aware of the dangers latent in their flock's surroundings, and, to the best of their ability, are on their guard against these. Some long-established diseases have known remedies that cure or prevent them, provided they have been accurately diagnosed. But as changes take place in our farming practices, particularly grassland management, so a set of, as yet, imperfectly understood conditions seem to arise with which the shepherd is less familiar. Certain well-established forms of ill-health take on a "new look". Each season too seems to bring its own particular problems for which it is good to be prepared. The recently published bulletin on *Diseases of Sheep** will, therefore, be of great practical interest to all those concerned with the management of sheep. This has been specially written for shepherds in non-technical language and deals with the several disease problems as part of day-to-day flock management. Attention is drawn to the various forms of ill-health as they occur season by season and urges the need for accurate diagnosis as to the cause of ill-health on which to base a suitable curative or preventive treatment. Only in this way can the measures recommended be successful. The bulletin is well illustrated and contains a valuable calendar of management routines aimed at preventing losses and ensuring good productivity. This the shepherd should find of great value. There is also valuable advice given on the care of syringes and on the biological product of choice in a given circumstance. It is pointed out, however, that although the shepherd can in many cases make a fairly accurate guess as to the cause of his losses, proof can only be obtained by an expert specially equipped for the purpose.

It is understood that a similar bulletin will shortly appear in Welsh in which those forms of ill-health most commonly found in the principality will be dealt with in detail.

Marketing soft fruit

Growers will be interested in a booklet, *The Handling, Precooling, Transport and Storage of Strawberries and Raspberries*, in which Mr. W. Hugh Smith of the Ditton Laboratory sets out what can be done effectively to ensure that soft fruit reaches the consumer or factory in the best condition possible.

Inquiries for further information, or for copies of the booklet, which is free, should be addressed to the Superintendent, Ditton Laboratory, Larkfield, Maidstone, Kent.

* Diseases of Sheep. *Ministry of Agriculture Bulletin No. 170.* H.M.S.O. 4*s.* (by post 4*s.* 4*d.*).

In Brief

UDDER AND MILK YIELD

Next to inherited productive ability, the udder ranks second as the basic dairy requirement. If many of the dairymen who have come to associate a large udder with a lot of milk would just take time to draw upon their own experiences, they would quickly realize that there is very little relationship between udder size and milk yield. This same experience would tell them that the large udder usually milks out slowly, requires prolonged stripping, is subject to excessive congestion at calving time, is more frequently injured, has a high rate of infection, and seldom lasts very long.

We should revise our thinking on what we strive for in the udder, and should definitely select for a small udder of medium length in front, firm in both fore and rear attachments, held up close to the body and with extreme quality. Such udders usually milk out quickly and completely. They will endure regardless of the amount of milk produced.

In the days of hand milking, short teats, especially on two-year-olds, were serious faults. To avoid the necessity of milking them with thumb and finger, we bred for length of teat that would permit use of the full hand. Thereupon, frequently, as the cow matured, these teats became too large. As the milking machine replaced the hand milker, the problem was completely reversed; a large, long teat just does not milk out well with a machine. A teat of medium length set neatly on to the udder floor with no funnelling of the quarter is what is desired. Funnelling of the quarter into the teat frequently produces a pocket that does not milk out. When this occurs it becomes necessary to massage the quarter upwards to dump the milk out. This is a time-consuming task which, if not done, is almost certain to produce udder trouble.

E. S. Harrison, The Rural New Yorker.

GUERNSEY RECORD

The highest lifetime milk yield recorded for a pedigree Guernsey in the United Kingdom belongs to Shiwa Cherqui's Doris, G.D.M., C.M., D.M., who, following an accident in which she sustained a broken hip, has had to be put down only three months short of her twentieth birthday. In fourteen lactations she gave a total of 183,186 lb milk and 7,721 lb butter fat. She calved for the fifteenth time on 10 February, 1956, and in this lactation she gave another 2,440 lb milk and 126 lb fat, bringing her lifetime total to 185,626 lb milk and 7,847 lb fat. She was then used for suckling calves.

The policy of line breeding to this cow has demonstrated her ability to transmit to her progeny both good looks and high performance. She has had 17 calves altogether, as two of her calvings produced twins.

Her first son, Shiwa Doris' Rose Lad 3rd D.M., was used for thirteen years at Hampshire A.I. Centre, and was put down recently after siring about 20,000 calves.

MORE FARMERS SHOULD MAKE SILAGE

The annual production of hay in England and Wales is between six and seven million tons. Allowing for the fact that silage contains four or five times as much moisture as hay, this means that something like eight to nine times as much grass is still made into hay as is ensiled. Analyses indicate that a good deal of the hay produced is not of high quality and too much is of low feeding value, some being little better than straw. Turning more grass into silage would improve the chances of making better hay. If more farmers who do not make

silage adopted this practice, they would find also that it would give them better control of their grass and would make it worth while to manure it. This would result in more grass and more nutritious fodder.

J. N. Sharrock, in World Crops.

THE DISAPPEARING HORSE

It is not only in Britain that farm horses are disappearing. The horse population of Europe as a whole is some 30 per cent less than it was before the war. The countries contributing to this figure range from Austria, with a 4 per cent drop, to the United Kingdom, with 72 per cent. In the United States the decline has been 71 per cent, in eastern Europe 27 per cent, in the Soviet Union 32, in north-western Europe about 33, but in southern Europe only about 8 per cent.

On the other side of the medal, there has been a rise in tractor numbers—ranging, for example, from 431,000 in Western Germany and 318,000 in the United Kingdom to 3,000 in Luxembourg and Portugal and 1,000 in Albania.

However, the decline in horses in some European countries is not necessarily a direct indication of advancing mechanization; there are large numbers of other draught animals—for example, draught oxen and cows are still used in large numbers in Western Germany, France, Italy and Yugoslavia. Mules and asses are important in Ireland; in Spain, Italy and Greece they outnumber horses. In several east European countries, oxen and cows are widely used as draught animals, and here new tractors may replace oxen or working cows before they have an effect on horse populations.

The great decline in horse numbers in Britain and the United States has been facilitated by the large average size of farms; the drop in horse populations has been much slower where there are a relatively large number of small holdings, as in several European countries.

It is thought, however, that the fall in the horse population may reach a point where greater mechanization will not meet all agricultural needs, and so more horses may have to be bred. Tractors are not always to be preferred to horses. Indeed, a study of probable minimum horse needs in the highly mechanized agriculture of the Netherlands shows that 187,700 horses are still being used, and it is estimated that eventually a minimum of 149,700 will be needed.

SIDMOUTH TROPHY, 1958

Forty-three carcasses from 25 farms competed for the Sidmouth Trophy at the Bath and West Show this year. Most of them were from the western counties, but exhibits came from as far afield as Notts and Kent.

There were 40 entries in the pure class (23 Landrace, 16 Large White and a Wessex Saddleback), and 3 in the cross-bred class (2 Landrace x Large White and 1 Landrace x Wessex Saddleback). The Landrace scored an average of 74·8 points, and took 16 of the first 19 places, including the first 7; Large White averaged 64·9, and cross-breds 65·6. The average for the whole entry was 70·2.

Six Landrace won full marks (15) for "length-for-weight," and another and two Large White scored 14. In "proportion of lean to fat," one Landrace gained 18 points, and two Landrace and four Large White 17 (out of a possible 20).

Competitors are reminded that entries for the carcass competition in next year's Bath and West Show, which will be held at Yeovil 3-6 June, should be submitted before 1 April.

Viscount Sidmouth.

PIG COMPOST FOR MUSHROOMS MASTERED?

Writing in the *Grower*, Mr. H. G. Schaffer records that after four years of experiments, Mr. C. R. Rasmussen, head of the mushroom department at the

Royal Agricultural Station, Copenhagen, believes he has mastered the technique of making compost from pig manure. For countries like Denmark, with a huge pig population and steadily diminishing supplies of horse manure, his work is of tremendous value. It is also important for Britain, where a number of mushroom growers are already mixing pig and horse manure.

Mr. Rasmussen's method is to stack the manure in piles about 4½ feet wide and about 4 feet high. Only the sides of the pile are gently pressed with the back of a manure fork and the centre kept as loose as possible. The air must penetrate the compost during the whole process, and if too much water is added air is excluded and the final product is greasy and unsuitable for the development of the mycelium.

A ton of composted pig manure covers only between 60 and 65 per cent of the area covered by a ton of horse manure compost, and when filling it must not be packed too tightly in the trays or beds.

A surprise during the latest experiments was the discovery that while supplements of sulphate of ammonia, calcium carbonate, superphosphate and gypsum materially increased yield from horse manure, they either decreased the yield from pig manure or had no effect.

Mr. Rasmussen says that he would not expect results to be as good from pig as from good horse manure, but he is satisfied that it can be considered a suitable growth medium and a good substitute for horse manure. It is, in his view, more efficient and cheaper than synthetics. He has not studied the effect of mixing horse and pig manure: this appears to offer scope for further investigations.

The Grower.

BROILERS GALORE

A broiler is defined in a recent issue of the *British Farmer* as a chicken reared on intensive lines to give a high-quality table bird, suitable for roasting or grilling, and killed at 9 to 13 weeks old at 3-4½ lb live weight. Broiler production in this country is growing rapidly, some estimates anticipating sales this year of some 25-30 million birds. One person can feed and water 1,000 birds comfortably with only one hour's work per day. A full-time worker—with temporary help to clean out buildings after each batch—can easily look after 10,000 to 20,000.

British eating habits, it is said, may be undergoing a revolution that will transform the chicken from a luxury food to a staple part of the diet in the next year or two, and broiler growers will not only enjoy a flourishing market but also help to lessen the quantity of red meat we need to import. But a note of warning is needed here. Broiler growers in the United States lost money last year through saturating the market—too many producers jumping on the "broiler band wagon".

British Farmer.

FARMERS' CLUB SECRETARY

Lt.-Col. R. L. Henson has succeeded Col. L. James as Secretary of the Farmers' Club.

Book Reviews

Insect Migration. C. B. WILLIAMS. Collins. 30*s.*

It has been very largely due to the enthusiasm of Dr. C. B. Williams that during the last few decades many naturalists, both amateur and professional, have become sufficiently interested in the problems of insect migration to help collect the data from which many interesting and important facts have emerged. Unfortunately it has been difficult for many people to obtain a comprehensive account of these discoveries as they have, of course, been published in various scientific journals. The latest New Naturalist book, *Insect Migration*, is, therefore, especially welcome, for in it Dr. Williams gives an up-to-date account of present knowledge on this subject.

The book is divided into four parts. The first, which consists of two chapters, is a general introduction to, and history of, the study of insect migration. The second, comprising four chapters, is an account of what is known about the movements of butterflies, moths, locusts, dragonflies, ladybirds, hoverflies and other insects. In the third part the author considers some of the problems involved in insect migration—problems of orientation and direction of flight; of the return flight; of abundance; and of geographical distribution, for example. The final part consists of a most interesting and, especially to those who may wish to carry out further investigations on this subject, useful account of marking, recording and other techniques that have so far been employed in the study of insect migration.

Dr. Williams marshals his facts, propounds his theories and draws his deductions with great skill, and in a manner which cannot fail to thrill his readers. The scientific attitude of mind in which he approaches his subject is well shown by the way in which he characteristically remarks that "it is so easy to make theories, but so difficult to find any which will fit the facts, all the facts and nothing but the facts".

This is an outstanding book and one which will, I believe, interest agriculturists, scientists, naturalists and many people in other walks of life. Furthermore it will surely lead to the collection of further data which will help to solve some of the outstanding problems of insect migration. These are not only of great interest but also, of course, of considerable economic importance, because such harmful insects as the Silver-Y moth, the cabbage white butterfly, and locusts, and such beneficial insects as ladybirds and hoverflies are well-known migrants.

C.G.B.

Plant Diseases due to Bacteria. W. J. DOWSON. Cambridge University Press. 32*s.* 6*d.*

This book is a second edition, with changed title, of Dr. Dowson's *Manual of Bacterial Plant Diseases*, published by A. and C. Black in 1949. The general arrangement of the earlier edition has been followed, with the addition of a short chapter on the preservation of bacterial cultures. There are over 40 half-tone blocks of high quality, most of which illustrate the effects of pathogenic bacteria on the host plant.

There are two most useful sections dealing with general bacteriology and the techniques of culturing, staining and examining bacteria. The third and largest section, concerned with bacterial plant diseases, has been considerably expanded, and many new references have been added which have greatly increased the scope of the book. Descriptions of the individual diseases are clear and concise, and attention is drawn to instances where confusion is likely to arise. A case in point is in the account of lucerne wilt (caused by *Corynebacterium insidiosum*), which may be confused with verticillium wilt. The features of the bacterial disease are described, and contrasted with those of the verticillium infection.

Helpful features like this characterize the book, which is as comprehensive and meticulous in detail as one would expect from such an authority as Dr. Dowson.

In view of its wide scope and its value to both laboratory and field workers, it seems unfortunate that the title of the second edition has been changed from the more truly descriptive one of the original.

R.L.L.

American Agriculture. RONALD L. MIGHELL. Chapman and Hall (London), Wiley (New York). 40*s*.

The main purpose of this book is to bring together, and comment upon, the vast amount of material relating to farming and farm families collected in the 1950 Census of Agriculture, and by the United States Departments of Commerce and of Agriculture. The first seven chapters deal with the bones of American agriculture—size of farm, farm incomes, trends, distribution of farming types, tenure, capital, labour and part-time farmers. These chapters are profusely illustrated with maps, charts and tables and, although not the lightest of reading, they give a clear and comprehensive picture of the framework on which policies and programmes must be built. And since American farm surpluses cast a menacing shadow over the farmers of the western world, the scope and trends of American farming are an essential study for anyone concerned with the economic outlook of British farming.

In the last three chapters there is a vast amount of useful and interesting comment on farm organization and co-operatives, and about the many ways in which the U.S. Government has tried to deal with mounting production. These chapters alone are well worth study, not merely for what is said about American farming but for the light they shed on our own related problems. The small farmer, so much in the news at home, is not a British problem—nearly 20 per cent of America's three and three-quarter million "commercial" farms are too small to yield a living for the family without outside work. About half the young people growing up on American farms must find employment outside the industry and those that remain in farming are faced with a serious problem in raising the capital necessary to make a start. Dr. Mighell forecasts that the occupiers of the low-income farms are likely to be worse off in the future; farm enlargement and the transfer of labour to other industries are problems that must be faced.

The census, as might be expected, throws up odd and interesting sidelights: as an oblique comment on human nature, in 1950 nearly all American farms had radios but less than a third had bath tubs!

There is a useful bibliography, and the text contains many valuable references.

N.F.McC.

Goat Husbandry. DAVID MACKENZIE. Faber and Faber. 36*s*.

As the dust cover tells us, this is the first comprehensive book on goats to be published in this country for over sixty years, and it is therefore of major importance to goat-keepers. Although the author gives many charts, tables and references, which will be of the greatest use to goat-keepers, I feel that the book is written principally for the general farmer and stock-breeder and for those who are interested in food production.

The chapter, specially written by a doctor, on the use of goat's milk in illness is excellent, like one on dairy produce, except that I would have preferred to see a more comprehensive list of cheeses that can be made from goat's milk. I do not agree with the statement, several times repeated, that goat's dung is dusty and therefore there is a risk of coliform bacteria in the milk, as I have seen the analysis of many samples of milk, and the bacteria count is always low—often nil.

Housing, breeding and feeding are all thoroughly dealt with, and the list of items noted as palatable to the goat is long and may surprise the farmer and layman. There is a short chapter on the goat as the universal foster mother, with rearing details for most types of stock.

Chapter 18 gives the economics of the various forms of goat-keeping, from the woodland farm to the domestic goat-keeper, and the keeping of goats to consume industrial waste products.

Mr. Mackenzie leaves us in no doubt that the goat can be of use to the general farmer as well as to the crofter, and to those who live beyond reach of the milkman; or to the few who breed goats for the export market and supply the milk to the public. Anyone not acquainted with the modern dairy goat will find

much of interest, and the illustrations alone will probably entirely revise his mental picture of this most intelligent and useful animal. Goatkeepers will find Mr. Mackenzie's slightly unorthodox ideas both interesting and stimulating.

M.F.R.

Annual Farming Digest and Agricultural Directory of Scotland, 1958. Edited by WILLIAM MACDONALD. Mearns Agricultural Publications. 7*s.* 6*d.*

Farmers in Scotland will welcome the fourth edition of this useful directory, which groups together for their handy reference a good deal of essential information.

The "Reference Section" lists the various official and allied organizations, research and educational centres, marketing boards, banking, insurance, gas and electricity services, trade and professional bodies, etc., which combine to turn the wheels of Scottish agriculture. A "Buyer's Guide and Classified Trades Section" gives the agricultural suppliers and contractors for each county.

In the "Breeds Section" the outlines, origins and developments of breeds of cattle are given, together with the addresses of the Breed Societies, the pedigree stockbreeders and notable pedigree stock farms. Both farmers and stockmen will find the notes on livestock rations most helpful.

Agriculturists in the south-west of Scotland are likely to appreciate the special feature on the Royal Highland Show, with its illustrated account of the farming, scenery and history of Ayr—a county celebrated not only for its famous poet, but for its pre-eminence in agriculture and stock-breeding. In his discerning article "Farming Aspects of Show Division", J. A. Gilchrist refers to some of the present-day problems of farmers in this area, and the adjustments and improvements that are possible.

The articles in the digest are both varied and thought-provoking. Graham Cherry shows in his article "Big Profits from Balanced Fertilizers" that the generous use of fertilizer on two small farms has proved remarkably profitable. Obviously, there is no easy formula for increased efficiency and profits, and the severe lack of capital imposes great stresses and strains on the farming industry. It is in this respect that the economist has proved himself to be the farmer's most valuable ally even if he is at times misunderstood. In the words of one of the contributors to the digest: "No one can show better where these stresses and strains lie than the economist, who needs more recognition, more co-operation and a little more heed paid to the results of his work. He is the coming key-man of farming's sciences."

P.A.E.

Profitable Poultry Production. E. D. PARNELL. Chapman and Hall (London), Wiley (New York). 40*s.*

The Professor of Poultry Science at Texas Agricultural and Mechanical College has written this book, mainly for students and Future Farmers—the American equivalent of our Young Farmer's Clubs. Although it is largely concerned with local conditions, particularly in respect of housing and rearing, the book has many points of general interest, and students and poultrymen over here will find it stimulating in many ways.

Each chapter starts with a list of "Jobs to be done and decisions to be made", and concludes with a number of questions for study and discussion, suggestions for field study and a list of references to books and bulletins. The first four chapters are rather general, and lead on to others dealing with broilers, feeding and laying flocks and to production and marketing of eggs and table birds. Finally, the volume deals with exhibiting and judging and gives a short look at the future of the poultry industry. In the chapter on feeding it is a pity that, from a scientific point of view, the table of vitamins on page 142 is arranged in a haphazard manner, without reference to importance or to the accepted classification into fat-soluble and water-soluble groups. Page 143 contains an error—the word "calorie" is used instead of "Calorie", thus dividing all quoted values by 1,000.

Like many American books, it is lavishly illustrated, though the value of many of the pictures is difficult to see. Some useful tables, a list of colleges and a short list of equipment manufacturers complete the book. The printing makes for easy reading.

W.M.A.

Useful Plants (Open Air Guides). A. SCHINDLMAYR (Translated by A. A. and J. P. Jackson). Thames and Hudson. 21*s.*

"With this book in his pocket" we are hopefully told, "the townsman or countryman should be able to identify any cultivated plant that he may come across in his ramblings." A guide to the naming of useful plants grown in our farms and gardens, it includes 20 grasses, 34 leguminous forage plants, various cereals, root crops and herbs, and many vegetables.

Useful Plants is chiefly a picture-book, with 338 illustrations in its 127 small pages. Each plant is illustrated by a line drawing or by a colour plate, and many are delightfully and characteristically portrayed. Least successful are the grasses and cereals, in which the flowering-head only is shown, and little idea of the plant's appearance is given.

The supplementary written information, arranged in tabular form, is slight; it comprises the botanical name of each plant, a description (often too short to be effective), and the briefest of notes on growth-period, seed-rate, soil requirements, yield and use. This information is distinctly meagre, and prompts the view that if the pleasing illustrations had been wedded to ampler notes, the book could have been made serviceable to a wider circle of readers. A useful feature deserving mention is a glossary of botanical terms extending to ten pages, well illustrated by clear drawings. The book appeals pleasantly to the eye, and may serve to introduce the cultivated plants to those unfamiliar with them.

T.A.R.

Looking at Chromosomes. J. MCLEISH and B. SNOAD. Macmillan. 16*s.*

If seeing is believing, this small volume should go far to relieve the uncertainties of students of biology who have limited facilities for individual microscopy or whose programme of studies necessitates some knowledge of, but provides little practical instruction in, the mechanics of sexual and asexual reproduction. Thanks to that obliging plant *Lilium regale*, whose internal structure is exceptionally well-defined, and whose chromosome-behaviour proceeds at a convenient pace, the authors have marshalled a series of microphotographs which illustrate with convincing clarity what happens when a living cell divides either in the process of growth or in that of reproduction. Accompanying these microphotographs are a number of equally brilliant diagrams, together with a brief text which is a sheer masterpiece of precise condensation.

Advanced students will enjoy this book for its perfection within the limited field it aims to cover. Beginners will appreciate it more as an illustrated and logically arranged aide-memoire, in that a brief search suffices to reveal the meaning and structure or mechanism of such details as anaphase, chromomere and zygotene (to mention but three of all the highly specialized words involved).

This book is not intended as a comprehensive survey of cell behaviour. Still less does it concern itself with what we commonly call Mendelism or genetics; it deals solely with structure and the mechanics of heredity, not with the characters that result from interaction between the genes and their environment.

G.E.M.

British Mammals. MAURICE BURTON. Oxford University Press. 11*s.* 6*d.*

Any book of quality devoted to the wild mammals of this country is welcome. Whereas books on birds pour out in a never-ending flood (many of them merely repetitive and unnecessary), those on mammals are still far from plentiful. And whereas, in places, the students of birds are already too thick on the ground for the comfort and well-being of their subjects, field workers who give any considerable amount of their time to mammals are few, and still have a great deal of territory to explore.

In the past we have had nature books that have been too wordy, and some that have had too many not particularly well-executed illustrations. This seventh volume of the *Oxford Visual Series* has achieved a happy and just-right medium and, as stated on the book's jacket, "text and illustrations are of equal importance". Moreover, both are good.

The book is stated to be designed for the beginner; it is simply written and all the better for that. Practically every aspect of mammal life is dealt with and, short though each of the thirty chapters is, dealt with quite adequately. The book

is all "meat". Hardly has the wish been formed for more, when one realizes that very little more is known today about the particular British mammals with which the book is concerned. What the author has really done is to impart, clearly and accurately, the greatest possible amount of information in no more than a necessary and seemly clothing of words—an example to be commended.

The book is attractively produced, and at 11*s.* 6*d.* is a good and economical "buy" for the would-be naturalist who wishes to know how wild mammals live.

F.H.L.

The Fruit Year Book, 1958. Royal Horticultural Society. 10*s.* (11*s.* 3*d.* by post).

The present volume is dedicated to Frank Matthews, who was second to none in the quality of his fruit trees—the outward sign of the sterling qualities of the man himself. It is notably one for the amateur fruit gardener, whether he is planning to start anew or to improve upon what he is already doing, or maybe to renovate what the neglect of his predecessor has brought near to ruin. To start with, staking garden trees is described with such practical thoroughness by Miss H. M. Hughes that there is little excuse now for strangled trees on the one hand, or on the other for token bits of string and sack loosely caught up in some obstruction near the foot of the tree.

The keen amateur seeking both variety and quick returns may well examine with Mr. E. W. Hobbis the merits of the dwarf pillar tree, harnessing vigour and productiveness at the same time.

Mr. N. H. Grubb's article on bush peaches should help to put them on the garden map, particularly if one thinks of all the massive unprofitable cherry trees still hopefully grown in smallish gardens —overshadowing precious space and when in fruit attracting birds from all the counties around. The peach has possibilities, within reasonable bounds, of beauty at flowering and profit at cropping time—and Mr. Grubb brings thirty years of practical experience to our assistance.

Another welcome aspect of this year's volume is the contribution made to the history of fruit culture, including the golden age of the great pomologies. This has been a sadly neglected field since the day of Edward Bunyard—distinguished bibliophile and pomologist—who took so much interest in the subject some thirty years ago. Perhaps we may look forward to further delvings into the past in future volumes of this valuable and well-established annual.

R.T.P.

Wye College Department of Hop Research Annual Report, 1956. 5*s.*

All who are connected with the hop industry will find this report filled with information of great interest and value. In addition to the account of the work carried out by the Department in 1956, there is an article, *Chemistry of Hop Constituents*, contributed by Dr. Howard of the Brewing Industry Research Foundation; and there are accounts of the 1956 hop season in the West Midland Province and South-Eastern Region by Mr. G. P. Chater and Miss C. L. Jary respectively (Hops Advisory Officers of the N.A.A.S.), and notes on hop research in other countries.

The report is well produced and the subject matter clearly expressed. Much of the information is naturally technical and of particular interest to scientific workers, but a concise non-technical summary of the work covered by the report is included, and enables all readers to understand the aims of the Department and the results achieved.

Annual reports such as this are commendable, as they keep the industry in touch with research work in progress, and help to reduce the time-lag between the establishment of new facts and their commercial application. It should, however, be borne in mind that in certain sections of the report the findings of recent experiments are dealt with. Sometimes further work on the subject may reveal necessary caution in the application of the results to commerce, owing to some consequential effect not directly covered by the particular experiment. For example, it is noted in the present report that, while brewing trials referred to in the report for 1955 indicated that hop-cones contaminated with captan (when used in the copper) caused no tainting of beer, brewing trials made in 1956 with similar hops indicated that the flavour may be adversely affected when captan-contaminated hops are used for "dry-hopping" beer.

A.H.B.

Co-operatives and Land Use. F.A.O., Rome. H.M. Stationery Office, London. 5*s.* (5*s.* 6*d.* by post).

A world survey of agricultural co-operation in the space of barely one hundred pages, for that is what this booklet is, would tax the "compression ratio" of anyone who did not have Miss Digby's remarkable grasp of her subject. Even she must have found the task of explaining, and commenting upon, the collectivization of Soviet agriculture in six short pages a real test of ruthless self-discipline!

In this volume Miss Digby describes and criticizes every variety of co-operation in the use of land, ranging from our own Land Settlement Association holdings to the Israeli "kibbutz", where co-operative principles have been practised to such an extent that even the children are taken away from their parents and placed in nurseries. The "kibbutz" is probably "the most complete form of communism, in the non-political sense of the word, that the world has known outside monastic communities". The complete disregard of family life seems strange and unnatural to our way of thinking and, even in Israel, the "kibbutz" type of co-operative has tended to give way to the "moshav ovdim", or co-operative village. However, a visitor from Israel recently told me that the members of the "kibbutz" have no wish to leave the community and, such is their prestige, that any one of them can have a commission in the Israeli Army for the asking.

Despite all the detail contained in this book, of the different methods of co-operation in various parts of the world, the general reader will doubtless read it with one question uppermost in his mind: "Is collectivization of agriculture a success or failure?" Miss Digby wisely does not avoid the question and, just as wisely, does not give a simple answer. Compulsory collectivization is rejected as a failure, but the success or failure of all forms of voluntary co-operation can only be judged in relation to the participants' political, economic, social and personal background. One thing is certain, however, ". . . in the long run agricultural progress depends on the intelligence and goodwill of the individual farmer, whatever his form of tenure." *B.E.C.*

Agricultural Research Council Report, 1956–57.

This is the first report of the work of the Council to be presented to Parliament under the Agricultural Research Act, 1956. It also includes a description of the development of agricultural research since the end of the war and of the methods adopted by the Council in carrying out its duties. Copies can be obtained from H.M. Stationery Office, price 7*s.* (7*s.* 6*d.* by post).

Books Received

South-Eastern British Friesian Breeders' Club Annual Journal, 1957–58. Obtainable from the Secretary, East Tye, Tyes Cross, East Grinstead. 2*s.* 6*d.* (3*s.* by post).

National Institute of Agricultural Engineering Annual Report, 1956–57. 12*s.* 6*d.*

The National Federation of Young Farmers' Clubs Annual Report, 1957. (Obtainable free from N.F.Y.F.C.).

National Institute of Agricultural Botany Annual Report, 1957. 2*s.*

The Advancement of Science. Volume XIV, No. 57, June 1958. The British Association for the Advancement of Science. 7*s.* 6*d.*

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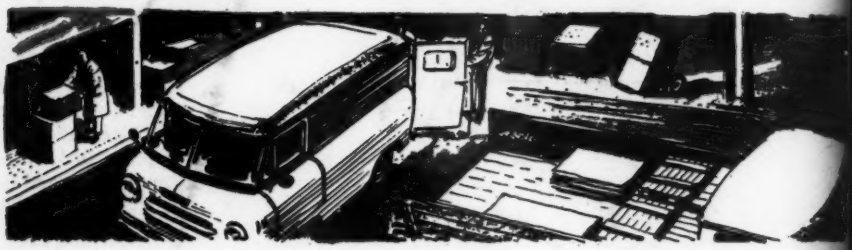

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